VOTING, PUBLIC GOODS AND VIOLENCE

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Voting, public goods and violence

Verkiezingen, publieke goederen en geweld

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Getting a PhD can be seen as finishing the process of education. In doing so, one looks back on a long period, in which the institutional part starts at the nursery school and ends at the university. A doctoral degree shows that one is able to do research independently and without it education as a scientist is unfinished. Writing this doctoral thesis to get the degree was for me a process that took me a considerable amount of time, effort, energy and perseverance. Nonetheless it also gave me the opportunity to recover from an accident, to become more mature and to open up. Being this reflective, many people who played a role in this come into my mind. I would like to thank them now, realizing that the list below is neither complete nor adequate.

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Klaas Staal
Rotterdam, Autumn 2004.

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Chapter 1

Introduction

This first chapter provides a short introduction to the topic of this thesis. Section 1.1 gives the main motivation behind the subjects discussed herein. In Section 1.2 the literature that is relevant to this thesis is briefly reviewed and relates the topics discussed in this thesis with those in existing literature. Section 1.3 provides an outline of the remainder of this thesis.

1.1 Goal and perspective

There are many diverse countries[1] in the world. Countries are different in many respects, like in shape, wealth, type of government, climate and size. Governments can be non-democratic or democratic, and in the latter case it can be a presidential-congressional or a parliamentary system, like respectively Venezuela or the Netherlands. Countries can be wealthy, like Luxembourg, with a GDP of $44009 per capita, or poor, like Tanzania, with a GDP of $482 per capita, and countries can be large like China with more than 1.2 billion inhabitants or small like Saint Kitts and Nevis with less than 40000 citizens.[2] Also the administrative division differs widely, with Cantons in Switzerland and States in the United States of America.

Obviously, borders between countries and within countries are influenced by historical, cultural or geographical reasons. The Pyrenees for example form a natural boundary between Spain and France. Although borders between countries and within countries are often taken as exogenously given in economic research, to a large extent they are, however, a man made institution. This implies that country borders can change, creating new countries and eliminating existing ones. Examples of the latter are the reunifications of East- and West-Germany and of North and South Yemen, both in 1990. On the other hand, the collapse of colonial empires, of the Soviet Union and of the Federal Republic of Yugoslavia, have increased the number of countries. Overall, the number of member states of the United Nations has increased from originally 51 in 1945 to 191 in 2002, a clear indication of the significant increase in the number of countries over the past few

[1] The terms "nation", "state" and "country" are used interchangeably throughout the thesis.

[2] Data from the Penn World Table (2002), income in real GDP per capita, constant price (Laspeyres).

decades. Also borders within a country can change: for instance in Switzerland the new canton Jura was formed out of the existing canton Bern in 1979.

Some border changes took place peacefully, like the reunification of Germany in 1990, but in the last decade of the 20th century the collapse of the Federal Republic of Yugoslavia was violently. Regionalism, separatism and various centrifugal forces are a latent factor in other cases, like in Quebec in Canada or Basque Country in Spain. In the former case the tendency to secessionism is manifested in a peaceful way, while in the latter case the ETA is an organization which is using violence to gain independence for a certain territory.

The examples mentioned above motivate several questions which are discussed in this thesis. The first class of questions are on the factors influencing country size, the second on the role of intergovernmental transfers and the last class of questions are on the role of violence in secession movements.

An example of a factor with a potential effect on country size is the form of government. In this thesis two types of democracy are studied to discuss the role of the form of government. The United States of America have a presidential-congressional democracy, while most countries in Europe have a parliamentary democracy and this may affect the size of these countries. A more general consideration for individuals is that the smaller the size of a country, the more influence they have on political decision making, but the smaller the benefits from economies of scale in public good provision and the smaller the other potential benefits from country size.

Intergovernmental transfers are made in many European countries, like Germany and Sweden. Transfers are made between the central government to local governments. Possible goals for such transfer schemes are altering the local governments' incentives for unification or the local governments' incentives for public good provision. The design of a transfer scheme logically has an effect on reaching these goals.

Violence and secessionism are related in cases like Basque Country and Northern Ireland. A study of the incentives of the groups conducting terror and of the groups suppressing terror may lead to a better understanding of these conflicts and may increase the possibility of a peaceful resolution of these conflicts.

Obviously, economists are not the only ones looking at the questions which are discussed in this thesis. Historians and political scientists have also studied these issues. A historian works on a chronological record of significant events effecting nations and on an explanation of the causes of these events. Political science studies topics like the nature of states, the functions performed by governments, voter behavior, political parties and political culture. This thesis has a different perspective, and although closely related to these two approaches, this work will only be mentioned indirectly. The approach used in this thesis is one from the perspective of a political economist. En economists studies how individuals choose to employ scarce productive resources. These resources can be used for the production of private and public goods, and an economist also looks at how these goods are produced and how they are distributed among individuals in a society. In political economy similar methods are used as the ones used by an economist or a political scientist, but in political science less attention is paid to for example normative aspects like the efficiency of outcomes. Likewise, the focus of an historian is also not on normative aspects of outcomes in history. This thesis thus looks at both normative and positive

aspects, at institutional design and at individual incentives. A more general comment on the approach in this thesis is that the models used in the discussion are extremely simple once compared to reality. This clearly has its limitations, nonetheless simplification and focusing are sometimes necessary to obtain useful insights in a complex reality.

1.2 Literature

This Section provides a broad overview of the existing relevant literature. Since each chapter is self-contained, the interested reader is referred to the introduction of the relevant chapter for more detailed descriptions of the literature. The description is split into three parts, the first part discussing the literature using the trade-off between the benefits of size and the costs of heterogeneity of preferences, the second part focussing on the role for intergovernmental transfers and the last part dealing with some of the literature on violence. In each part, some research questions are mentioned that are not discussed in the existing literature and that are studied in this thesis.

Public good provision and preferences

The interest of economists in country formation is relatively new. In one of the earliest research papers on this topic, Friedman (1997) argues that nations are shaped to maximize joint revenue, net of collection costs. In his work revenue from trade is a factor increasing country size, while rent is one decreasing size. Boundaries are closed or coincide with cultural boundaries to maximize exit costs. These exit costs are also mentioned by Buchanan and Faith (1987), who argue that the possibility of secession puts a maximum to the extent a ruling coalition can impose on a minority. The papers by Casella (1992) and Casella and Feinstein (2002) use a locational model to study the relationship between preference heterogeneity and public good provision in a country. Heterogeneous individuals are trading with each other, and public goods facilitate trade. Trade, however, takes place in markets, while public good provision takes place in jurisdictions that do not necessarily coincide with the markets. For small markets, multiple jurisdictions are possible but not desirable, while for large markets, multiple jurisdictions are possible as well as desirable. The approach of using unidimensional spatial models goes back to Hotelling (1929) and is similar to the approach used in Chapters 2, 3 and 4 of this thesis.

In these chapters, the trade-offs between benefits of country- and regional size and the costs of heterogeneity of preferences are central in the discussion. For analysis using a similar approach, the book "The size of nations", written by Alesina and Spolaore (2003), provides a very good introduction.

Some other work by Alesina and Spolaore (1997), uses a spatial model to study the heterogeneity of preferences individuals have over public good provision. This work is closely related to the research presented in Part I of this thesis. The core assumptions of their approach are the following. Individuals are located on a line segment, their locations representing the preferences over public good provision. A nation is represented by an interval on the line segment and a nation is defined by the public good it provides in its

capital and the boundaries between nations are endogenous. The payoff of an individual is decreasing in the distance to the location of the public good. The costs and benefits of public good provision are both fixed.

In this framework, the benefits from living in a large nation are the lower per-capita costs of the public good, while on the other hand individuals have higher transportation costs in larger nations. The individuals located near the border between nations bear the biggest cost of the political configuration. When they secede, however, they do not take into account the externality this poses on the other individuals. Under democratic decision making there will be too many countries, due to the excessive incentives for separation individuals located near the border have. In the case where countries are governed by self-interested individuals maximizing tax revenue, however, there can be less countries than the number which would maximize the aggregate payoff. An important conclusion from the analysis thus is that democratization leads to the creation of more countries.

Several related questions, however, have not been investigated in this line of work. Firstly, boundaries are not completely endogenous in many cases. Due to historical, cultural or geographical reasons, some regions have certain sizes, and the countries in general contain these regions completely instead of dividing these regions between several countries. Secondly, the existing literature ignores the question how the incentives for separation and unification are related to the desire to provide more public goods and the incentives to have more influence on the type of the public goods provided. Thirdly, the fixed-costs fixed-benefits assumptions for the public good disregard that larger countries have the possibility to have a larger total amount of public goods. Individuals living in large countries, however, can benefit from the fact that more public goods are provided by larger countries. This evidently affects an individual's trade-off between the costs and benefits of country size

Intergovernmental transfers

The existing research looking at the merits of centralized and decentralized public good provision are related to the literature on country formation mentioned above. The work done by Helsley (2004) could serve as a first introduction to the issues playing a role, discussing the objectives of local policy formation and the influence of local political institutions. This line of research is close to Part II of this thesis, where local public goods with positive spillover effects are studied.

The research on country formation and on local public good provision can be seen as an outgrowth of the local public finance literature and of the literature on fiscal federalism. One of the first papers of the former literature is the work by Tiebout (1956), and one of the first contributions on fiscal federalism is by Musgrave (1959). In this thesis, the role of transfers is studied in a framework in which heterogeneity of preferences plays a role. This analysis is much in the spirit of the analysis done by Ellingsen (1998). Another recent contribution that is closely related to analysis presented in Chapter 5 of this thesis is Besley and Coate (2003).

Besley and Coate study a model in which local public goods have positive spillovers. Local public goods can be provided centralized or decentralized. The relative performance of centralized and decentralized decision making depends upon the degree of spillovers

and the heterogeneity in preferences over public good provision. Their main finding is that centralized decision making results in excessive spending or misallocation of public goods. The decision to centralize local decision making, however, is not endogenous. Decentralized and centralized decision making is also studied by Ellingsen (1998). In this model, there are inter- and intra-regional differences in preferences and the regions differ in size. The individuals in both regions can decide to centralize decision making. Centralized decision making takes into account the spillover from the public goods, but neglects minority interests. Ellingsen finds that there can be either too little or too much integration and that often small regions tend to oppose integration with large regions.

In this branch of literature, the effects of a scheme of intergovernmental transfers are not studied. Such a transfer scheme exists in many countries, for example in Germany, in the United States, in Sweden and in the Netherlands. One of the aims for such a scheme could be to mitigate the deviations from the outcome that is optimal from a social welfare point of view. There is some research on intergovernmental transfers, but jurisdictional boundaries are taken as given. For a survey of this research, see Oates (1999). Intergovernmental transfers can be used not only to influence the decision on local public good provision, but also to alter the incentives to centralize decision making.

Violence

Relatively few economists have done research on the interplay of violence (or terrorism) and secessionism, the topic discussed in Part III of this thesis. For violent action, however, scarce resources are needed and often, as a result of violence, other resources are destroyed, thus making violence a relevant topic for economists. For a discussion of the economic costs of violence, see for example Abadie and Gardeazabal (2003), who study the effect of terrorist activity by the ETA on per capita GDP in Basque country. Indeed they find that violence has a negative impact, and that this impact depends on the level of violence. This study also contains a description of the recent history of the conflict.

Another example of violent secessionism is the conflict between Israelis and the Palestinians. For a description of this conflict, see Berrebi and Klor (2004). This paper also uses a discrete-time dynamic optimization approach, investigating the interaction between terrorist attacks and electoral outcomes in Israel. One of their hypotheses is that the expected level of terrorism is higher when a left-wing government is in power, and they give some evidence for this result. A static game theory-model with a similar prediction is used by Kydd and Walter (2002). In the model trustworthiness and ability of the parties involved play a role. Kydd and Walter also present some evidence that Hamas plans attacks when there is a high probability of reaching an agreement.

The existing literature does not contain a discussion comparing the nature of different terrorists groups. The approaches used are often specific to one conflict, and therefore do not compare the consequences of the distinct objectives parties may have in various cases. Given the different characteristic of the conflicts, the players involved in the Israeli/Palestinian conflict may have different aims compared to the players involved in for example the Spain/Basque country conflict. These distinctions can have an effect on the strategic behavior of the parties involved and are therefore important for understanding, and probably untangle, these conflicts.

The discussion on terrorism in this thesis thus focusses on the decision whether to leave terrorists the free hand and the choice of the terrorists between a high and a low effort level to conduct terror. Both are on the one hand costly options, but on the other hand these options may increase the payoffs since they can influence the actions chosen by the parties involved in a conflict.

1.3 Outline of this thesis

This thesis consists of five chapters discussing the influence of public good provision, transfers and violence on the size of jurisdictions. The chapters are aimed at answering the questions discussed in the previous section. Recurrent themes in the chapters are the decisions to join or to break up jurisdictions. Based on the different approaches used in each of the five chapters, the chapters can be grouped into three parts. The trade-off between the benefits country size has on public good provision and the costs in terms of a possible loss in political influence on the type of public goods to be provided lies at the basis of the first part. The next part looks at the role of transfers on the incentives to provide public goods and the incentives for unification of local jurisdictions. The last part studies the interplay between violence and secessionism.

Part I of this thesis consists of Chapters 2, 3 and 4. Chapter 2 examines the incentives of regions to unite and separate. Separation allows for greater influence over the nature of political decision making while unification allows regions to exploit economies of scale in the provision of public goods. Since the boundaries between regions are often given due to for example historical, cultural or geographical reasons, the role of regional size is studied. Somewhat surprisingly, it turns out that smaller regions have greater incentives to unite than large regions. Then the chapter explores the influence of regional location and of diversity within regions in shaping these incentives. The investigation of the role of regional size and regional location is motivated by the fact that often more than two countries are involved. In the dispute on Kashmir, for example, India and Pakistan play a role and this is discussed in a three-regions version of the model. The diversity in preferences over public good provision is of importance since in general the population is not distributed uniformly over a region. The chapter also examines the way in which alternative political institutions aggregate regional preferences and thereby define the number of countries. This also helps to asses the robustness of the main findings. Finally, the implications for social welfare are discussed.

In Chapter 3 the incentives of regions to unite, to separate and to provide public goods are studied. Again, separation allows for greater influence over the nature of political decision making while unification allows regions to exploit economies of scale in the provision of public goods. The analysis is motivated by the observation that instead of separation and the formation of independent countries, individuals in regions can choose to form a federation. In a federation, the public good provision possible under separation can be duplicated, while it is still possible to keep some of the benefits unification has.

Chapter 4 examines the equilibrium size of countries. Individuals in smaller countries have greater influence over the nature of political decision making while individuals in large

countries have the advantage of more public goods and lower tax rates. This analysis is motivated by the fact that larger countries provide more public goods than small countries. Next to this, the effect of the massive increase in public spending in the 20th century is studied. The chapter also looks at the question whether the differences between a presidential-congressional and a parliamentary democracy have an effect on the size of a country.

Part II consists of Chapter 5. This chapter analyzes local public good provision in a country consisting of a large number of heterogeneous regions, each comprising two districts, a city and a village. The districts can choose to remain autonomous or to unite, and the local public goods provided in each district have positive spillover effects on the neighboring district. The majority voting outcomes on unification and public good provision are compared with the optimal outcome from a social welfare point of view. The chapter also discusses how intergovernmental transfers can mitigate the deviations of the majority voting outcome from the socially optimal outcome. Such a system of intergovernmental transfers exists in many countries, for example in Germany, in the United States and in the Netherlands.

Part III contains Chapter 6, which deals with violence and secessionism. This analysis is motivated by the observation that in several cases secessionism goes together with violence. The chapter discusses the incentives of moderates and terrorists, both agitating for independence. The terrorists are willing to use violence and it is argued that there are two types of terrorists, those who are willing to compromise, and those who are not. The moderates can choose to suppress the terrorists. The chapter also discusses how the incentives for the terrorists relate to the likelihood that there will be a successful secession.

Chapter 7 provides a summary of the results and the main conclusions of this thesis and some issues for further research. Finally, at the end of this thesis there is a summary in Dutch.

Part I

Public good provision and preferences

Chapter 2

The political economy of regionalism

Co-author: Sanjeev Goyal

2.1 Introduction

During the last fifty years, the number of nations has increased dramatically from 74 in 1946 to 193 in 1997. Many of these countries were born out of the decolonization process in Africa and in the rest of the world. During the same period, we witnessed a move towards greater integration in Europe, accompanied by lowering of boundaries between countries. In addition, during this period, more than twenty boundaries between nations were changed, without creating or eliminating a nation.[1] More recently, referenda have been held in many countries and these have resulted in substantial changes in boundaries (as in Northern Ireland, Scotland and Wales in Great Britain and East Timor in Indonesia). In this chapter we develop a framework to examine the incentives of regions to separate and unite. We then examine the social welfare implications of voting decisions made on the basis of regional preferences.

Our framework has the following features: there are two regions which can choose to be independent countries or to unite and form one country. Regional preferences are derived on the basis of majority voting in each region. If there is disagreement between the regions then the two regions separate. After the decision on unification and separation, individuals in each political territory choose the type/location of government they want to have. This determines, for example, where the capital, the national airport, the universities and other facilities are located. In this spirit, location choices may be interpreted geographically. The individuals living close to the capital then have the highest payoff. The model also

[1] See The Times Atlas [1993, Plate 8] for a survey map on border changes and changes in sovereignty since 1945 and Alesina, Spolaore and Wacziarg (2000) for more data on country formation since 1870.

permits an interpretation in terms of individual preferences more generally.[2] We suppose that a country requires a government and that there is a fixed cost of this government. This assumption generates a trade-off: separation allows individuals within a region to exercise greater influence in political decision-making, while union allows them to exploit economies of scale in the provision of government.[3]

We *first* examine the role of regional size in shaping this trade-off. Our finding is that *unification takes place between relatively similar sized regions* (Proposition 2.3.2). This result arises out of the different ways in which the political costs of unification compare with the tax advantages. In particular, political costs of unification vary linearly with the size of the other region, while the tax advantages are increasing and convex in the size of the other region. This implies that relative to the costs the gains from unification increase for the small region as it gets smaller; on the other hand, the gains from unification decline for the larger region as the small region becomes smaller. Thus large regions are reluctant to form unions with small regions while small regions are keen to form unions. One implication of these preferences is that unification only occurs if costs of government are relatively high and if regions are roughly of the same size. Moreover, small regions are more in favor of unification as compared to large regions.

We next examine the social welfare implications of decisions made on the basis of these regional preferences. Our main finding is that *majority voting leads to excessive separation, from a social point of view* (Proposition 2.3.4). The excessive incentives arise out of the way the costs and benefits of unification are distributed and the externalities this generates. The costs of separation in terms of higher per capita tax rates are borne equally by individuals in a region. On the other hand, the benefits of separation depend on an individual's location. Individuals located close to the boundary between the regions lose relatively more from separation while individuals away from the boundaries gain more from separation. Thus an individual's vote on unification/separation generates externalities on other voters; in particular, our analysis shows that the voting rule tends to under-represent the interests of the former set of voters and that this leads to excessive separation. The rest of the chapter explores the influence of different features of the regions and the political institutions on these findings.

We start by examining how diversity within the regions affects the basic trade-off between unification and separation identified above. Our *first* observation is that given a

[2]In the latter preference interpretation, individuals who are close to each other are assumed to have the same preferred type of government. Governments located far from individuals differ more from the preferred type of government of these individuals than from the preferred type of government of the individuals who are located in close proximity of the government. The choice of the type of government, for example, can determine which social security system will prevail. The people who live close to the capital or equivalently, who prefer the prevailing social security system, have a higher payoff than other individuals.

[3]This trade-off as well as some other features are similar to the model presented in Alesina and Spolaore (1997). The relationship of this chapter with their work is discussed in detail below.
Alesina and Wacziarg (1998) present empirical evidence that supports the existence of scale effects in the provision of government.

size configuration of the regions, clustering in the large region makes unification more attractive for the large region but less attractive for the small region. The intuition for this comes from noting that tax benefits are independent of distribution, while the political costs vary with change in location of the government under unification. If preferences are clustered around the median voter in the large region then government will not move much under unification. Hence the political cost is modest and the large region prefers unification. The *second* observation is that the distribution of preferences in the smaller region is essentially irrelevant for the trade-off between union and separation, (Propositions 2.4.1-2.4.3). These findings suggest that individuals in a large region may be more willing to form a union with small regions if they are themselves clustered/concentrated, while small regions will be less eager to form a union with a large region, in spite of the tax advantages, if this is the case.

We then examine the strategic role of regional location. We suppose that there are three regions located on the unit interval. We are able to completely solve the model for the case where the corner regions are of the same size. In this setting, we find that *irrespective of the sizes of the different regions, the central region's most preferred alternative is a union between all three regions.* This is because a union delivers tax advantages while there are no political costs since the regions on the corners are of equal size and the location of the government remains unchanged under unification. This preference in combination with the incentives of very small and relatively equal sized regions to unite (from the basic model) yields us the outcome that *the three regions unite and form one country if the size of the corner regions is very small as well as when it relatively large.*

One of the main findings in the basic model is that majority voting generates excessive incentives for separation. We next examine the role of alternative political arrangements in mitigating this inefficiency. Recall that in the basic model, political outcomes are based on majority voting in each region followed by separation in case of disagreement between the regions. We *first* explore the effects of this default option. We now suppose that the outcome in case of disagreement is unification. When we apply this default outcome, we find that *the excessive incentives for separation persist* (Proposition 2.5.1).[4] It is possible that a nation-wide referendum could be better at internalizing the externalities discussed earlier. This motivates an exploration of a nation-wide referendum. We find, however, that *the outcome under a nation-wide referendum is the same as in the case where separation only takes place when both regions agree on separation*, (Proposition 2.5.2). Thus excessive separation persists under these two alternative voting rules. If there are only a few individuals in the small region then the tax burden on these individuals is very heavy. One way out of the outcome of separation would be for the small region to accept unequal or unconditional union. Under this arrangement, voters in the large region decide the location or type of the government, but people in both regions pay for it. We note that under this rule, a large region is always in favor of union. However, the small region is willing to pay the political costs only if it is sufficiently small. This suggests that *unequal union is likely to take place if the regions are of very different sizes.*

[4]Inefficient outcomes under majority voting have also been pointed out in other contexts; see Besley and Coate (1998) for a general analysis of inefficient outcomes under majority voting in the context of repeated elections.

We finally examine the stability of different political arrangements and their normative appeal. Our main finding is that within the class of majority voting rules investigated, *the voting rule with two referenda (one in each region), supplemented with union as the default outcome, is stable – in the sense that it is chosen in a vote among different voting rules – as well as normatively appealing.*

This chapter is a contribution to the study of country formation and secession. Inspired by the recent redrawing of boundaries in Eastern Europe and the former Soviet Union, there has been considerable interest in these issues in recent years, see e.g. Alesina and Spolaore [1997], Bolton and Roland [1997], Casella and Feinstein [2002] and Wei [1991a, 1991b].[5] In particular, this chapter is closely related to the papers by Alesina and Spolaore [1997] and Wei [1991a, 1991b].

Alesina and Spolaore [1997] study the influence of different factors, such as the level of market integration and democratization, in determining the number and size of countries. They use the same trade-off as we use: the economic advantages of unification are compared with the political costs of a government which is located further away in a larger country. In this setting, they find that democratization leads to an inefficiently large number of countries. In their analysis, the boundaries between nations are endogenous but they restrict attention to outcomes with equal sized countries. By contrast, in this chapter the focus is on different features of the regions, such as size, location and their internal diversity in shaping the trade-off noted above. We are particularly interested in the role of initial asymmetries along these dimensions. To focus on these factors, and to keep the model tractable we assume that the boundaries of the regions are exogenously specified.[6] The assumption of exogenous boundaries also allows us to examine in detail the impact as well as the stability of alternative political institutions.

Wei [1991a, 1991b] examines a model in which the size of the regions is exogenously specified. Moreover, he allows for the level of a public good in a nation to vary depending on the level of economic development and the size of the nation. The trade-off in his model is between the higher efficiency of the public good under union and the lower coordination costs under separation. Our analysis differs from Wei's in that we consider a fixed-costs public good and this leads to a very different trade-off: we compare the efficiency gains in terms of one as against two governments with the political costs of greater distance to the government. In addition, we also study the nature of socially desirable outcomes.

[5]This recent political economy work is related to the local public good literature and the literature on fiscal federalism. For the local public good theory, see Austin [1995], Benabou [1993], Bewley [1981], Epple and Romer [1991], Jehiel and Scotchmer [2001], Rubinfeld [1987], Scotchmer [1996], Stahl and Varaiya [1983] and Tiebout [1956]. For literature on fiscal ferderalism, see Oates [1972], Persson and Tabellini [2000] and Wildasin [1988].

[6]While tractability is the primary motivation for our formulation, it is worth mentioning that in some cases pre-existing borders do play an important role when interstate borders are redrawn. For instance, when the Soviet Union broke up, Belarus and Moldavia became independent partly because they already existed as states within a federal union. Similarly, when Italy unified, decisions on unification were made separately in the Bologna region and in Tuscany because these regions existed as separate political units. We are grateful to an anonymous referee for suggesting these examples as a motivation for the assumption of exogenous boundaries.

The remainder of this chapter is organized as follows. In Section 2 we present the basic model. Section 3 presents the outcomes under majority voting as well the socially optimal outcomes. Section 4 examines diversity within regions and the strategic role of regional location, while Section 5 explores the impact of alternative political arrangements. Section 6 concludes.

2.2 The model

We suppose that one public good identifies a nation (i.e. a country); we call this public good the 'government'. The range of all possible governments is normalized in the segment $[0, 1]$. The location of a government is denoted by l. In addition, we assume that the total population has mass one and that individuals from this population are located at ideal points, which indicates their preferred government. The individuals are uniformly distributed on the segment $[0, 1]$. The utility of each individual is decreasing with the distance from his government to his location (i.e. his ideal point). The distance between the ideal point of a consumer i and the government in his country is denoted by d_i.

We assume that there are two regions with a a fixed (exogenous) boundary α. The region located on the left-hand side of α is called region A, while the region on the right-hand side of α is called region B. We suppose that $0 < \alpha < 1/2$. We assume that there is a fixed cost F per country, regardless of its size.[7] This F includes for example the costs of building airports and hospitals and the costs of having a machinery of government. In the basic model every individual has the same, exogenous income y, and pays the lump-sum tax t_i.[8] Now, we can define the utility function for each individual i as follows:

$$U(i) = g(1 - ad_i) + y - t_i \tag{2.1}$$

where g and a are two positive parameters. The parameter g measures the utility of the public good when the preference distance d_i is zero and the parameter a measures the loss in utility if the government is farther away (i.e. when d_i increases). The utility function is thus linear in the preference distance. We assume that $a < 1$, which ensures that a higher g increases utility. The parameter a can then be interpreted as the marginal utility of a government located at a distance d_i. We look at the incentives for separation and unification under majority voting and we assume that separation occurs if a majority of voters is in favor of separation in at least one region.

[7] When the costs of a government depends on the size of the country, we could model the costs as $F = f + \zeta s$ where s denotes the size of the country. We conjecture that, as long as f and ζ are positive, our main results will carry over.

[8] Proportional taxation with different tax levels across regions is not sustainable when the subject of taxation (e.g. capital or labor) is mobile in a union. In the model with exogenous income levels which are equal across the regions lump-sum taxation is equivalent to proportional taxation. We assume that individual wealth is equal in the two regions. We examine the case of unequal wealth across regions in Appendix B.

2.3 Regional incentives and the social optimum

In this section we will first examine the outcomes when decision to form one or two countries is taken by majority voting and then we will derive the socially optimal number of countries.

Majority voting: We first observe that if α is very small then the per capita cost of supporting an independent government, F/α, becomes very large and the individuals in region A will benefit significantly from unification. Hence small regions will typically prefer to have a union. The individuals in region B also compare the benefit of a lower tax rate under unification with the disadvantage of a change in the location of the public good under unification. This comparison depends in turn on how political costs and the tax advantage varies as the size of regions varies. Our analysis of these issues is summarized in Proposition 2.3.1. We define $\alpha_A = 2F/ga$ and $\alpha_B = 1 - 2F/ga$.

Proposition 2.3.1. *Region A prefers unification if and only if $\alpha < \alpha_A$ while region B prefers unification if and only if $\alpha > \alpha_B$. Thus unification only takes place if $\alpha_B < \alpha_A$ and $\alpha \in [\alpha_B, \alpha_A]$.*

We first observe that the preferences of the person in the center of a region reflect the majority opinions in each region: *In a region, there is a majority in favor of separation if and only if the median voter in that region prefers separation.* This is a direct implication of the median voter theorem.[9] The incentives for unification and separation can therefore be derived by comparing the payoffs of the median voter in each of these cases. These computations are now presented. Let $U_I(i)$ be the utility of voter i under unification, and let $U_{II}(i)$ be his utility under separation.

Proof of Proposition 2.3.1: There will be a majority in favor of unification in region A if the median voter $\alpha/2$ prefers unification:

$$U_{II}(\frac{\alpha}{2}) = g + y - \frac{F}{\alpha} < g(1 - a \mid \frac{1}{2} - \frac{\alpha}{2} \mid) + y - F = U_I(\frac{\alpha}{2}) \tag{2.2}$$

That is, if

$$\alpha < \frac{2F}{ga} = \alpha_A \tag{2.3}$$

There is a majority in favor of unification in region B if the median voter $(1+\alpha)/2$ prefers unification:

$$U_{II}(\frac{1+\alpha}{2}) = g + y - \frac{F}{1-\alpha} < g(1 - a\frac{\alpha}{2}) + y - F = U_I(\frac{1+\alpha}{2}) \tag{2.4}$$

That is, if

$$\alpha > 1 - \frac{2F}{ga} = 1 - \alpha_A = \alpha_B \tag{2.5}$$

[9] In our setting, preferences over the location of the public good are single-peaked and the policy space is single-dimensional. It follows that in case of separation the public good will be located at the mid-point of the region, while in case of unification, the public good will be located at the point 1/2. It is now straightforward to check that if the median voter (say) in region A (who is located at $\alpha/2$) prefers separation then all voters in the interval $[0, \alpha/2]$ will prefer separation. Likewise, if the median voter prefers unification then all voters in the interval $[\alpha/2, \alpha]$ will prefer unification.

This completes the proof. □

Our interest is in the relationship between the size of a region and the incentives for unification and separation. The incentives for unification depend on the magnitude of the tax advantage as against the costs of political distance. The above computations show that the two effects – the political costs and the tax advantages of unification – do not influence utility in the same way. The influence of the preference distance is linear in α but the influence of a lower tax rate is non-linear in α. In particular, the tax advantage from unification is $F/\alpha - F$ for Region A, and $F/(1-\alpha) - F$ for Region B. It follows that the tax-advantage from unification is increasing in the size of the other region and is a convex function of the size of the other region. Figure 2.1 illustrates this aspect of the trade-off.
This figure allows us to derive the outcomes under majority voting. We summarize them in the following result.

Proposition 2.3.2. *The outcomes under majority voting are given as follows: (a) If $F < ga/4$ then the regions remain independent for all $\alpha \in [0, 1/2]$, (b) if $ga/4 < F < ga/2$ then there is unification if and only if $\alpha \in [\alpha_B, 1/2]$ and, (c) if $ga/2 < F$ then there is unification for all $\alpha \in [0, 1/2]$.*

This Proposition says that if costs of having a government are very small or very large then the political outcomes are independent of the size of the two regions: in case they are very small the regions remain independent, while if costs of having a government are large they form a union. The role of size surfaces if the costs of having a government are at an intermediate level, where $ga/4 < F < ga/2$, since in this case union occurs for $\alpha \in [1 - 2F/ga, 1/2]$. Note that the expression $1 - 2F/ga$ is decreasing with respect to F. A rise in the costs of having a government will therefore make unification more likely. If the maximum benefit from the government, g, increases then $1 - 2F/ga$ will also increase and unification becomes less likely. The same holds for an increase in the preference intensity a.

The social optimum: It is socially optimal to have two independent nations when the gain due to lower political costs outweighs the additional costs of having two governments. It is therefore only socially optimal to have two independent nations when the fixed costs of the public good are low. If the small region is very small, then there will be only a few individuals in the small region which will benefit from a separate government. It is therefore only socially optimal to have two independent nations if the two regions are both of reasonable size. These considerations are summarized in the next Proposition. Let $F_{SP} = ga/8$ and $\alpha_{SP} = 1/2 - \sqrt{1/4 - 2F/ga}$.

Proposition 2.3.3. *If $F < F_{SP}$ then union is optimal if and only if $\alpha < \alpha_{SP}$. If $F > F_{SP}$ then union is the unique optimal outcome.*

The computations are provided in Appendix A. We now turn to a comparison between the outcomes under majority voting and the socially optimal outcomes.

Majority Voting and Social Optimum Compared: A comparison of the outcomes under majority voting and the social optima reveals:

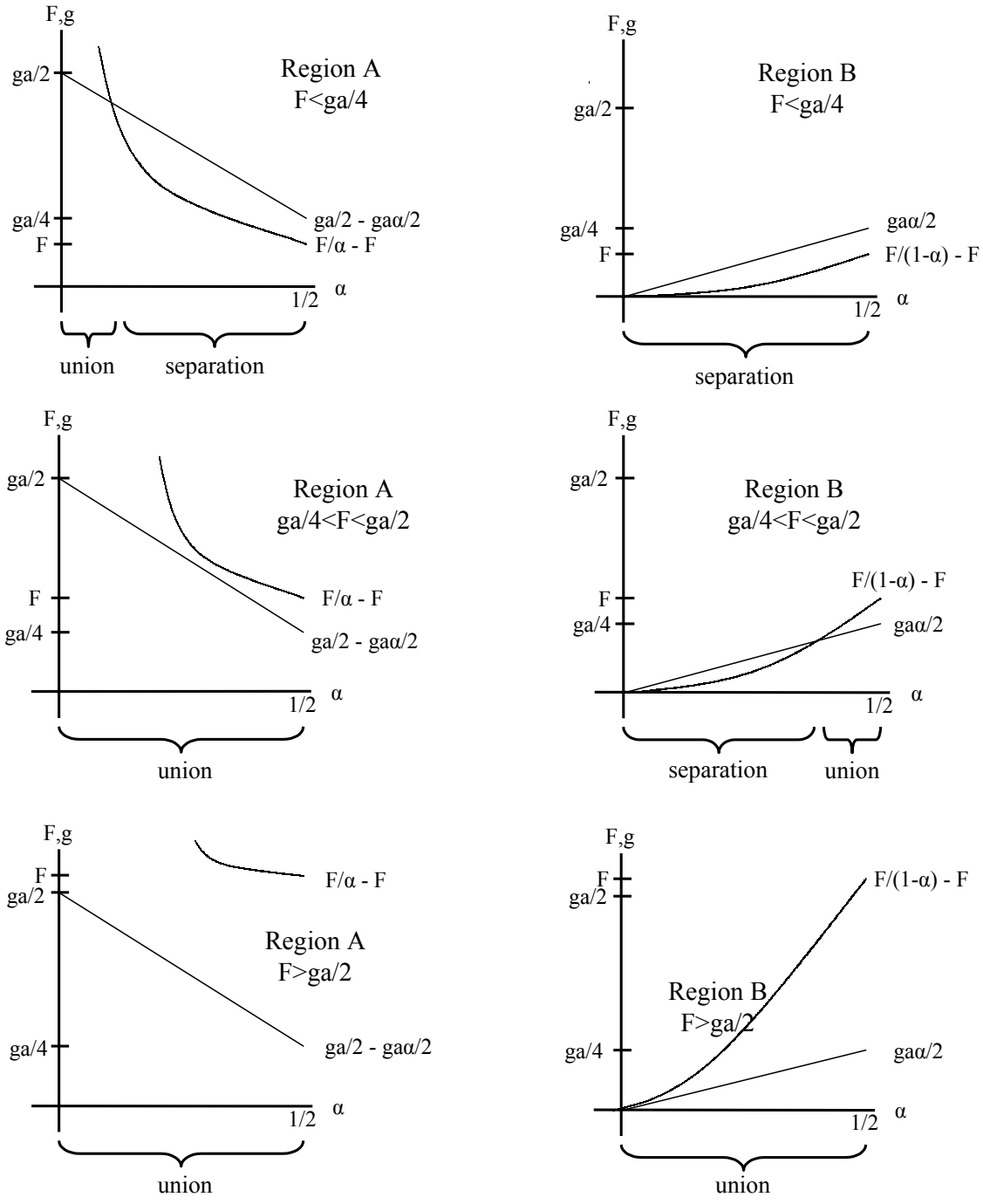

Figure 2.1: Majority voting outcomes.

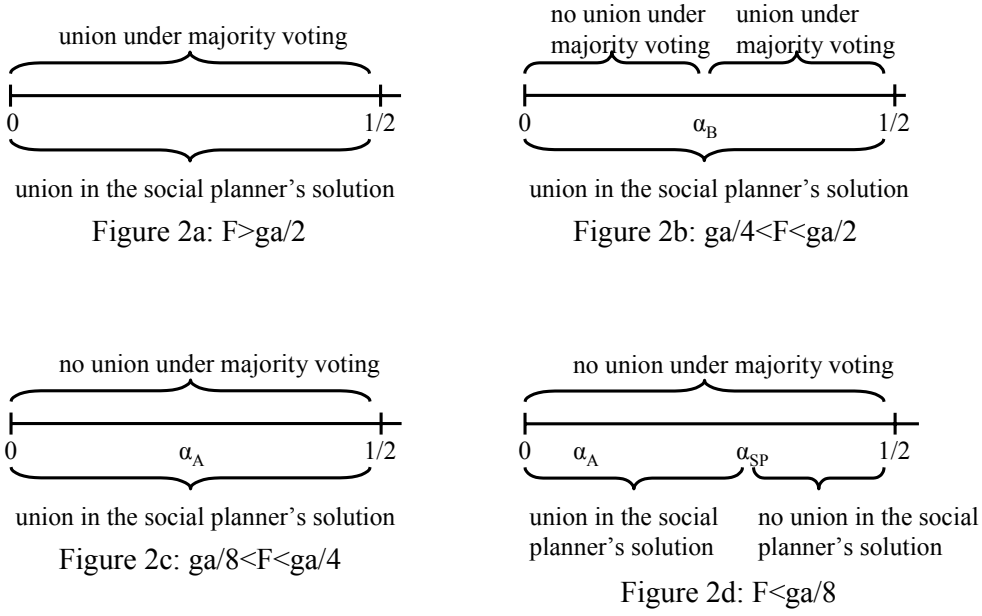

Figure 2.2: Majority voting and social optima.

Proposition 2.3.4. *(i) If $F < ga/8$ then unification is socially optimal for all $\alpha \in [0, 1/2 - \sqrt{1/4 - 2F/ga}]$ but separation obtains under majority voting for all $\alpha \in [0, 1/2]$, (ii) if $ga/8 < F < ga/4$ then unification is socially optimal for all $\alpha \in [0, 1/2]$ but separation obtains under majority voting for all $\alpha \in [0, 1/2]$, (iii) if $ga/4 < F < ga/2$ then unification is socially optimal for all $\alpha \in [0, 1/2]$ but separation obtains under majority voting for all $\alpha \in [0, 1 - 2F/ga]$, and (iv) if $F > ga/2$ then union is socially optimal as well as the majority voting outcome for all $\alpha \in [0, 1/2]$.*

These results are illustrated in Figure 2.2.[10]
The main finding of the above result is that there exist excessive incentives for separation under majority voting: for certain parameter values majority voting obtains separation but the socially optimal solution is unification. We now elaborate on the sources of this inefficiency.

The excessive incentives arise out of the way the costs and benefits of unification are distributed and the externalities this generates. The costs of separation, $F/\alpha - F$ for the small region and $F/(1-\alpha) - F$ for the large region, are borne equally by the individuals in each region because of the lump-sum taxation system. On the other hand, the benefits of separation of an individual depend on the location of the individuals. The individuals located close to the boundary between the regions will loose the most from separation, and

[10]Note that $F < ga/8$ implies $2F/ga < 1/2 - \sqrt{1/4 - 2F/ga}$ and $1 - 2F/ga > 1/2 - \sqrt{1/4 - 2F/ga}$ (and thus $2F/ga > 1 - 2F/ga$), that $F > ga/4$ implies $1 - 2F/ga < 2Fga$ and that $F > ga/2$ implies that $2F/ga > 1$ and $1 - 2F/ga < 0$ (and thus $1 - 2F/ga < 2F/ga$).

in both regions the individuals away from the boundary gain the most from separation. The aggregate increase in the payoff of these individuals (located towards the corners), however, is less than the aggregate decrease in the payoff of the individuals located close to the boundary between the two regions.

The analysis of the basic model yields us two principal insights. *Firstly*, that the large region typically is less keen on unification as compared to the small region. This result is due to the fact that the tax advantages from unification are increasing and convex in the size of the other region, while the political costs are linear. Thus a union with a very small region fails to generate adequate tax advantages for the large region (in the interesting class of parameters). *Secondly*, we find that outcomes under majority voting typically lead to too much separation as compared to what is socially optimal. This is due the fact that whereas the tax advantages of unification are shared evenly by voters in a region, the political costs are unevenly distributed and this generates externalities which lead to inefficient outcomes. We will now discuss the empirical and normative implications of our findings.

Relation with empirical patterns: The main prediction of the basic model is that unification will only take place between similar sized regions and that there are situations in which a small region prefers unification while a large region is averse to unification and hence no unification takes place. How does this prediction square with empirical observation? Our observations pertain to unification among unequal sized regions. The *first* remark is that in many instances large regions are relatively more interested in unification as compared to small regions. One manifestation of this is the desire of regions to secede or seek greater autonomy from large countries, who in turn resist these attempts (examples of this include Kashmir and Assam from India, and Chechnya from Russia). This seems to go against the prediction of the model and motivates a closer examination of the assumptions of our model. It can also be the case that a region has to choose between independence, union with one country or union with another country. It is possible, for example, to think of Northern Ireland as a part of Ireland or as a part of the United Kingdom, as it (still) is at present. It is unlikely, however, that Ireland and the United Kingdom will form a union. Another example is South Tirol (between Italy and Austria; in Italy this region is now part of Trentino Alto Adige). In Section 4 below we will explore the role of the distribution of preferences and the strategic role of regional location in shaping incentives for unification and secession. Our *second* observation pertains to the phenomenon of *unequal union* – a situation in which a small region contributes to the public good but has virtually no say in the policy making. There are several instances of this arrangement; for example, the Dutch central bank used to base its monetary policy on the German Bundesbank; presumably the costs of running an independent policy were too high. Other examples include small countries like Luxembourg being essentially passive members of NATO, Liechtenstein participating in a customs union with Switzerland, using the Swiss Francs as its national currency, and Puerto Rico whose citizens do not vote in the US presidential elections. Our finding that there are situations in which small regions may want union while large regions are averse to union provides an explanation for why such unequal unions arise. We explore the scope of unequal union formally, in Section 5 below. A *last* remark concerns wealth differences. It is widely argued that

wealth and income differences are one of the main factors behind regional movements which seek secession. Some examples of this are Belgium (between Flanders and Wallonia), Italy (between north and south Italy), Catalonia (vis-a-vis the rest of Spain) and Norway (vis-a-vis the European Union). Our analysis of introduce wealth differences is presented in Appendix B.

Normative aspects: Our results suggest that using majority voting in each region to make decisions on unification and separation may lead to socially suboptimal outcomes. This finding leads us to investigate alternative voting mechanisms. In the basic model the default outcome in case of disagreement between regions is separation; this outcome is realistic when in an initially unified nation, the central government is too weak or does not want to prevent secession through military means. An instance of this is the disintegration of the Soviet Union; it is arguable that parts of the country such as Russia did not favor secession, but it took place nonetheless because the central government could not prevent other regions from seceding. This voting rule is also relevant when two initially independent nations are considering political integration. In many cases, however, these conditions may not hold. There may, for example, exist an authoritarian regime in an initially unified nation which can stop secession supported by just one region but which cannot stop secession supported by both regions. In some institutional settings, democratic approvals of secessions require separate majorities in each region. For example, Aruba, an island in the Caribbean Sea is still a part of the Netherlands. The Dutch constitution allows changes in the status of Aruba if the governments of Aruba and the Netherlands both agree. Although there was at least a wish by Dutch politicians for an independent Aruba, this was blocked by the island. Alternatively a regime in an initially unified nation may want to prevent secession because secession may mean a loss of prestige or lower tax revenues. These considerations motivate the examination of a default rule that if two regions differ then the outcome is union. The final decision rule we consider is a nationwide referendum. This rule is motivated by examples of countries where the parliament decides on the borders of individual states as well as on whether a region can be allowed to secede. If the parliament is elected in a nation-wide election, then we may interpret a national parliament deciding on the break up of a nation as analogous to a nation-wide referendum. An example of this is the vote on the break up of Czechoslovakia in the parliament.[11] The analysis of alternative rules and their stability is presented in Section 5.

[11] In fact, in the Czechoslovakia example there were three votes on the separation agreement: one in the Czech part, one in the Slovak part, and a third one in the Czechoslovakian parliament. In all votings there was a majority in favor of separation. Proposition 2.5.2 below may be interpreted as saying that either the vote in the Czechoslovakian parliament or the two votes in the Czech and the Slovak parliaments were superfluous.

2.4 The role of diversity and location

2.4.1 Diversity

One of the assumptions in the basic model is that the individuals are uniformly distributed over the unit interval. In general, populations are not uniformly distributed over regions and the preferences of individuals are typically clustered. This motivates the examination of the role of concentration of preferences. We note that an explicit model of clustering/concentration also allows us to distinguish between the influence of the size of a region and the diversity within the region.

We start with an examination of the incentives of the large region. The boundary between the two regions is at α and an α proportion of the individuals is in region A and the remaining $(1-\alpha)$ proportion of the individuals is in region B, as before. To keep matters simple, we shall suppose that individuals are uniformly distributed over the interval $[(1+\alpha)/2 - b/2, (1+\alpha)/2 + b/2]$, with $b < 1-\alpha$. When b is small, we have a high clustering/concentration of preferences, while for large b we approximate the case of uniform distribution.

If $b = 0$, then all voters in region B are identical and located at the middle of region B, which is then also the location of the median voter. If $\alpha < 1/2$, then it follows that the public good will be located at $(1+\alpha)/2$, both in case of separation as well as in case of unification. Thus there are no political costs and definite tax advantages from union for the large region and that therefore it will always prefer unification. We note that this preference is independent of the location of the median voter in the small region. The following result explores the incentives of the large region more generally.

Proposition 2.4.1. *Suppose that $b < 1-\alpha$. Then there exists a cut-off cost of the public good $F_B(b)$ such that a majority of the individuals in the large region prefers unification if and only if $F > F_B(b)$. Moreover, $F_B(b) = 0$ at $b = 0$ and $F_B(b)$ is strictly increasing with respect to b. These preferences are independent of the distribution of preferences in the small region.*

Proof: For a fixed α, the median voter compares the tax benefit with the political costs of unification. The tax benefit $F/(1-\alpha) - F$ is independent of the distribution of individuals. The political cost of unification, however, depends on the distribution of individuals in the large region. Under separation, the public good is located at $(1+\alpha)/2$. Under unification, the public good will be located at

$$\frac{1+\alpha}{2} - \frac{b}{1-\alpha}\frac{\alpha}{2}. \tag{2.6}$$

Hence the political costs of unification are given by

$$\frac{b}{1-\alpha}\frac{\alpha}{2}ga. \tag{2.7}$$

The median voter in the large region therefore prefers unification if

$$F > \frac{gab}{2} = F_B(b). \tag{2.8}$$

Note that $F_B(b)$ is increasing in b and is equal to 0 at $b = 0$. The result follows upon noting that the computations are valid for any distribution of preferences in the small region, given a value of $\alpha < 1/2$. □

We now study how the incentives for unification and separation in the smaller region depend on the distribution of preferences.

Proposition 2.4.2. *Fix a location of the median voter in the small region. Preferences over unification and separation in region A are independent of the distribution of preferences in that region.*

Proof: The tax benefit $F - F/\alpha$ of unification does not depend on the distribution of the individuals in the smaller region. Given the assumption on the size of the regions, that $\alpha < 1/2$, the public good will always be located in the larger region. Moreover, the precise location of the public good will depend only on the distribution of individuals in the larger region and is independent of the distribution of individuals in the smaller region. For a fixed α and a given median voter, it follows that both the tax benefit as well as the political cost of union for an individual in the small region does not depend on the distribution of the individuals in the small region. The preferences over unification and separation in region A are therefore insensitive to the distribution of the individuals in region A. □

We next examine the impact of preference distribution in the large region on the incentives for unification and separation in the small region. Recall that b is a measure of diversity of preferences in the large region.

Proposition 2.4.3. *Let the median voter in the small region be located at $\alpha/2$. There exists a cut-off cost of the public good, $F_A(b)$, such that a majority of the individuals in the small region prefers unification if and only if $F > F_A(b)$. Moreover, $F_A(b)$ is strictly decreasing in b.*

Proof: We examine the preference of the median voter in the small region. The utility from separation is given by

$$U_I(\frac{\alpha}{2}) = g + y - \frac{F}{\alpha} \tag{2.9}$$

Under unification, the public good is located at $(1+\alpha)/2 - b\alpha/2(1-\alpha)$. The payoff in a union is therefore given by

$$U_{II}(\frac{\alpha}{2}) = g(1 - a|D|) + y - F \tag{2.10}$$

where $D = 1/2 - b\alpha/2(1-\alpha)$. Thus, the median voter in the smaller region prefers separation over unification if

$$F > \frac{\alpha}{2(1-\alpha)^2}[1 - \alpha - b\alpha]ga = F_A(b) \tag{2.11}$$

Note that $F_A(b)$ is decreasing in b. □

Remark: The qualitative properties of $F_A(b)$ hold for any location of the median voter; the assumption that the median voter is located at $\alpha/2$ is used to compute the specific function $F_A(b)$.

Propositions 2.4.1-2.4.3 clarify the influence of the distribution of preferences on the essential trade-off identified earlier. We find that the distribution in the large region is very important while the distribution in the small region is essentially irrelevant. Greater diversity in the large region makes unification more attractive for the small region, while greater concentration (lesser diversity) makes unification more attractive for the larger region. The intuition behind this is that the greater the diversity in the large region, the greater the influence of the small region on the location of the government after unification; correspondingly, the greater this influence the greater the political cost for the large region and the smaller the political cost for the small region. This illuminates an interesting point: small regions prefer to unite with diverse large regions, while large regions are more in favor of unification if they are less diverse themselves. Our findings are consistent with the stylized fact that democratization leads to greater secession an break-up in countries. This is because democratization takes diversity more into account and this can lower the incentives for unification in the large region.

2.4.2 The strategic role of regional location

In the basic model, we have assumed that there are only two regions and that the boundary between the two regions is fixed. This section will examine the implications of relaxing these assumptions. We suppose that there are three regions located on the unit interval: region A is located on the left hand corner, region B is located on the right hand corner, while region C is located in the center.

Symmetric case: We will first examine the nature of the majority voting outcome in the setting where regions A and B are of equal size. Our first observation concerns the preferences of the central region: this region always prefers unification of the three regions due to the fact that in a union with the other two regions the location of the public good will be the same as when region C remains independent. The tax rate, however, will be lower in a union, making region C strictly better off. The two regions at the ends of the interval, A and B, by contrast prefer to be independent if the fixed costs of a public good are low. We therefore have to specify what happens when the preferences of the majority in the different regions are different.
We will look at majority voting outcomes which have the core property: there does not exist a union of regions which is preferred over the current majority voting outcome by a majority of the individuals in each of the regions of the union. The boundary between region A and region C is fixed at α. In the symmetric case the boundary between region B and region C is therefore fixed at the value $1-\alpha$. The formal analysis of core outcomes is given in Appendix A. We now discuss the findings and clarify the connections with the findings in the basic model.
First, we find that given a value of F, there is a cut-off level $\hat{\alpha}$ such that for all $\alpha < \hat{\alpha}$, the unique stable outcome is the union of all the three regions. This outcome appears to differ from the outcome we observed in the basic model. Recall that in that model,

unification occurs only if $F > ga/4$ and even then it occurs only if the regions are of relatively equal size, i.e., for large α. The principal reason for this change in outcome is the change in the preferences of the large region. In the three regions model, the central region's most preferred outcome, independently of its size and the value of F, is the union between three regions. In the two regions case, by contrast, the large region prefers union only with a relatively large region. This contrast illustrates the importance of location in shaping regional preferences between union and separation.
Second, we find that if $F > ga/4$ then there exists some $\hat{\alpha}$ such that $\alpha \in (\bar{\alpha}, 1/2)$, the unique outcome is the union of all the three regions. The reasoning behind this outcome is as follows: the central region C always prefers such a union, while regions A and B prefer such a union due to cost-sharing reasons. This is analogous to the intuition behind the result obtained in the basic model that relatively equal regions prefer unification.
Our *third* finding pertains to the relation between α and the pattern of union and separation. In the three regions case, we find that union occurs for very small as well as for very large α, but generally there is either independence or a union of only two of the regions for intermediate values of α. The precise outcome depends on the value of F, with the three independent regions outcome being stable for low F and the union between two regions being stable for large F.
Finally, we find that for fixed α, raising F typically increases the level of integration in the majority outcome. This is intuitive and also in line with our findings for the basic model.

Central region incentives: In the previous part of this section we assumed that the regions A and B were of equal size. This assumption allowed a complete characterization of the outcomes under majority voting. We would also like to explore the case where the two regions are of unequal size. This is the aim of the present subsection. Due to the numerous cases involved, we have not been able to solve this case completely. We shall focus on the incentives of the central region, which is denoted throughout as region C. This region has the choice of joining region A or region B, or of remaining independent. This setup is realistic in cases where we have three regions and where two of the three differ too much to form a union but where the third region is in a position where it can join either of the two regions. Moreover the two regions are in principle willing to have a union with the central region.
We consider a special case to obtain insights into the issues involved. We fix the boundary between regions A and region C at 1/10, and vary the boundary between region C and region B. Region C, in the center, will prefer to be independent if the costs F are low. For large F, region C will prefer a union with the largest of the two other regions. In this case it is important to share the fixed costs of the public good with as many individuals as possible. For intermediate values of F, matters are more complicated. If region C is small then it prefers to join the larger region, while if it is itself large then it prefers union with the smaller of the two other regions. When a region is small it is important to share the fixed costs of the public good with more individuals but when a region is not too small the political costs of unification become more important and the region might prefer to join with a smaller region or it might prefer independence. A formal statement of these findings (along with the proof) is provided in Appendix A.

2.5 Alternative Political Institutions

In the basic model we assumed that unification occurs if a majority in each of the regions prefers unification. In this section we examine the robustness of the main findings under alternative political arrangements. We *first* consider the role of the default outcome, i.e. the rule that specifies what happens when the majority voting outcomes in the two regions are different. *Second*, we explore the nature of majority voting outcomes under one nation-wide referendum. *Third*, we examine the effects of unequal union: this is an outcome in which one region gives up the influence on the location of the government. *Finally*, we examine the endogenous determination of different voting rules.

2.5.1 The default outcome

In the basic model, we apply the following majority voting rule. In each region a referendum is organized over unification and separation. If there exists a majority in favor of unification in both regions then union takes place; otherwise, the regions remain separate and form two countries. In this section we consider the following alternative majority voting rule: *In each region a referendum is organized over unification and separation. If there is a majority in favor of separation in both regions then separation takes place; otherwise the two regions remain united.* Under majority voting a default outcome specifies what happens if the regions do not agree. For the majority voting rule used in the basic model the default outcome is separation. For the majority voting rule we will now use, the default outcome is unification.

We start by observing that socially optimal outcomes do not change with a change in default outcome rules: *The socially optimal solution is independent of the default outcome. Hence, the socially optimal solution in the model with union as default option is the same as the socially optimal solution in the model with separation as the default outcome.* The intuition behind this is straightforward. In the socially optimal solution the decision on unification and separation is taken by maximizing total utility and not by considering a possible difference in preference of majorities in each region.

We next note that the conditions on α for a region to prefer unification are the same as in the basic model and therefore identical to those identified in Proposition 2.3.1. In fact a useful reformulation of Proposition 2.3.1 is: *There exists an α_A such that a majority in region A prefers separation if and only if $\alpha > \alpha_A$ and there exists an α_B such that region B prefers separation if and only of $\alpha < \alpha_B$.* In the proof of Proposition 2.3.1 we determine the conditions on α by comparing the payoffs of the median voter under unification and under separation. Using the new majority voting rule neither the median voter nor his utilities are changed, so the conditions on α will also be the same.

Since we have changed the default outcome from separation to unification, we require a majority in favor of separation in both regions for separation to occur. Using the majority voting rule with unification as default outcome and using Propositions 1-3, it is easy to derive Figure 2.3.

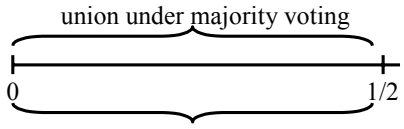

Figure 3a: F>ga/2

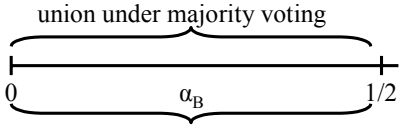

Figure 3b: ga/4<F<ga/2

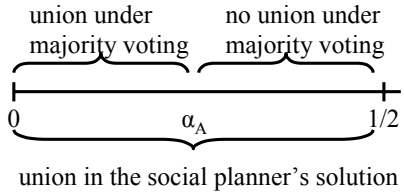

Figure 3c: ga/8<F<ga/4

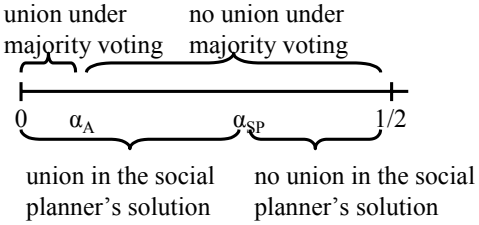

Figure 3d: F<ga/8

Figure 2.3: Union as default option.

In the next result we provide the exact conditions for unification and separation under majority voting as well as the nature of socially optimal outcomes.

Proposition 2.5.1. *(a) If $F < ga/8$ then unification is socially optimal for all $\alpha \in [0, 1/2 - \sqrt{1/4 - 2F/ga}]$ but separation obtains under majority voting for all $\alpha \in [2F/ga, 1/2]$, (b) if $ga/8 < F < ga/4$ then unification is socially optimal for all $\alpha \in [0, 1/2]$ but separation obtains under majority voting for all $\alpha \in [2F/ga, 1/2]$ and (c) if $F > ga/4$ then unification is socially optimal as well as the majority voting outcome for all $\alpha \in [0, 1/2]$.*

When the default outcome is changed from separation into unification we expect that union becomes more likely. Indeed, unification is now the majority voting outcome in more cases. However, even in this setting, there are parameter ranges where the majority voting is separation, while the socially optimal outcome is unification. This highlights the robustness of the finding concerning the inefficiencies of the majority rule, obtained in the basic model.

2.5.2 One nation-wide referendum.

In the majority voting rules we have studied so far separate referenda are organized in each region. We observed that these rules generate excessive incentives for separation. This motivates an examination of a more inclusive political rule: a nation-wide referendum. We note that if separate referenda are held in each of the regions, then it is possible that the results of these referenda are not the same. It is therefore necessary to specify a default outcome which defines what happens in that case. When there is a nation-wide referendum, there is no need to specify a default outcome.

The following result derives the conditions under which separation is supported in a nation-wide referendum.

Proposition 2.5.2. *There exists a majority in favor of separation in the whole nation if and only if there exists a majority in each region in favor of separation.*

The proof is given in Appendix A. This result is somewhat surprising and so we elaborate on the arguments underlying the proof. First note that the individual located at 1/2 always prefers unification over separation. This follows from the fact that there are tax-advantages of unification as well as lower political costs, since the government is located at 1/2 in a union. The second observation pertains to the linearity of the political costs. If one of the regions prefers unification, then it follows that the median voter in that region prefers unification over separation. The linearity of the political costs under both unification and separation implies that all the voters between the median voter (say) $\alpha/2$ and the end-point 0, also prefer unification. Moreover, it is obvious that if the median voter prefers unification then so do all voters located between $\alpha/2$ and α, since they have a similar tax burden but lower political costs of unification. Finally, the linearity of the political cost for voters between α and 1/2 along with the fact that the voter at 1/2 always prefers unification implies that they too prefer unification over separation. We have therefore shown that all voters in the interval $[0, 1/2]$ prefer unification. The argument now follows from the continuity of the utility function, with respect to location. Proposition 2.5.2 says that if majorities in both regions prefer separation there will be two separate countries and in all other cases, the outcome will be union with a single country. This is exactly the outcome we observed under the majority voting rule with two referenda and unification as the default outcome. Proposition 2.5.1 therefore also holds when we apply the voting rule with one nation-wide referendum and the outcomes are as illustrated in Figure 2.3. The result on excessive incentives for separation thus also holds when a nation-wide referendum is held to decide on unification and separation.

2.5.3 Unequal political union

¿From the analysis of the basic model it follows that the smaller region (region A) prefers unification if α is small but the large region (region B) prefers separation in this case. In case α is small, the gain in terms of a lower tax rate is outweighed by the loss in terms of political relocation of the government. However, for region A the per capita cost of government becomes too big for small α. Therefore, it may be attractive for region A to ask region B for unification even if the location of the public good is determined solely by region B. We call this *unequal* or *unconditional* union. In this political arrangement, region A gives up its political influence in the hope of a significant tax reduction.
We begin by noting that the larger region, Region B, will always accept unequal union: the individuals in region B will then have higher utility since there is reduction in the tax rates while there is no loss of political influence. In cases where region B prefers equal union over separation and region A is willing to accept an unequal union there arises a bargaining problem. To keep matters simple we will assume that in such cases equal union will take place. Given this assumption, we find that the outcomes are as follows. Define $\alpha_{uu} = 2F/(ga + 2F)$.

Proposition 2.5.3. *The outcomes under majority voting supplemented with the option of unequal union are as follows: (a) If $F < ga/4$ then there is unequal union for $\alpha \in [0, \alpha_{uu}]$ and separation otherwise, (b) if $ga/4 < F < ga/2$ then there is unequal union if $[0, \min\{\alpha_{uu}, \alpha_B\}]$, separation if $\alpha \in [\min\{\alpha_{uu}, \alpha_B\}, \alpha_B]$ and equal union if $\alpha \in [\alpha_B, 1/2]$, and (c) if $ga/2 < F$ then there is equal union for all $\alpha \in [0, 1/2]$.*

Proof: We first note an implication of the median voter theorem: In region A there is a majority in favor of unequal union against the alternative of separation if the individual in the centre of region A is in favor of unequal union. We also note that region A always prefers equal union over unequal union. Clearly, everyone in region A prefers equal union over unequal union. Therefore, there will be a majority in region A for unequal union if the individual $\alpha/2$ prefers unequal union, i.e., if

$$U_{uu}(\frac{\alpha}{2}) = g - \frac{ga}{2} + y - F > g + y - \frac{F}{\alpha} = U_{II}(\frac{\alpha}{2}) \tag{2.12}$$

That is, if

$$\alpha < \frac{2F}{ga + 2F} = \alpha_{uu} \tag{2.13}$$

Thus *region A prefers unequal union over separation if and only if $\alpha < \alpha_{uu}$, where $\alpha_{uu} = 2F/(ga + 2F)$*. We can now use Propositions 2.3.1-2.3.2 to complete the proof. □

From the above result it is clear that for some cases, such as when $\alpha \in [0, \alpha_{uu}]$, unequal union is preferred over separation by the smaller region. Unequal union thus softens the negative consequences of excessive separation under majority voting. As one might expect, there will be unequal union if and only if there is a large difference in size between the regions.
We note that the nature of efficient outcomes remains the same: the socially optimal solution in the model extended with unequal union is the same as the socially optimal solution in the basic model. This is because in our computations of the socially optimal solution we allowed for arbitrary locations of the public good. A comparison of outcomes under majority voting and the socially optimal outcome is presented in Figure 2.4.[12]

2.5.4 Endogenous political institutions

So far we have considered a number of political institutions. We have found that the rules under which voting is carried out have a significant influence on the nature of the outcomes as well as on the level of social welfare. This motivates an examination of their relative merits. In this section, we will first examine the normative appeal of the different rules and then we will examine their stability. Our principal finding is that the outcomes of the majority voting rule in each region supplemented with union as the default outcome is normatively appealing as well as enforceable.

In what follows we shall refer to the two region-wide referenda with separation as a default outcome as Rule I. We recall that outcomes under the two region-wide referenda

[12]Note that $F > (\sqrt{5} - 1)$ga/4 implies that $\alpha_{UU} > \alpha_B$.

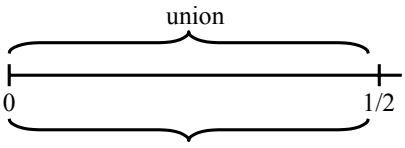

Figure 4a: F>ga/2

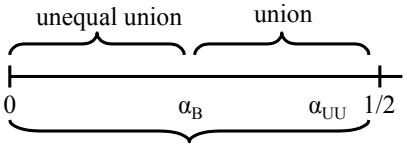

Figure 4b: (√5-1)ga/4<F<ga/2

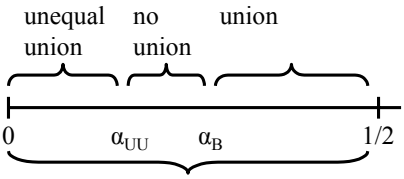

Figure 4c: ga/4<F< (√5-1)ga/4

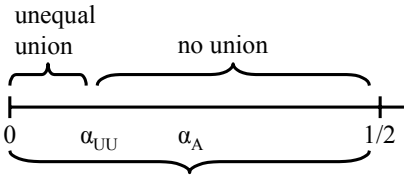

Figure 4d: ga/8<F<ga/4

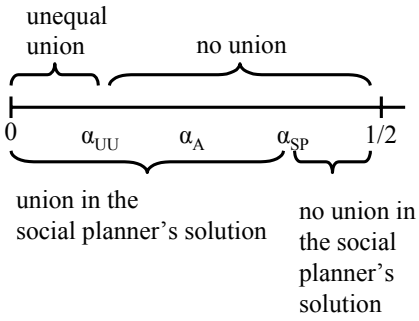

Figure 4e: F<ga/8

Figure 2.4: Unequal union.

with union as default outcome, and the outcomes under a single nation-wide referendum are identical. In what follows we will therefore only consider the former rule and we will refer to it as Rule II. In addition we will refer to the unequal union option as Rule III.

From a normative point of view, we would like to implement the rule with outcomes closest to the socially optimal outcome. It follows from the analysis in Sections 3 and 5 that Rule II induces outcomes closest to the socially optimal outcomes. Rule II is thus the most attractive from a normative point of view.

We now examine the stability of different rules. We shall say that a voting rule is *stable* if in a nation-wide vote a majority of voters prefers this rule to any other rule. We start with a comparison between Rules I and II. First note that in all cases where unification is the outcome under Rule I it is also the outcome under Rule II. Next note that in cases where separation is the outcome under Rule II it is also the outcome under Rule I. Hence, in all these cases individuals will be indifferent between the two rules. The interesting cases to check are therefore those in which the majority voting outcome is union under Rule II while it is separation under Rule I. Using Propositions 2.3.1-2.3.2 and Propositions 2.5.1-2.5.2 we can deduce that this difference in outcomes is only possible if a majority in the small region prefers unification, while a majority in the large region prefers separation. We next observe that all individuals located between α and $1/2$ will prefer unification over separation since in a union they will pay less taxes and the public good will be located closer to them. Finally, we note that if the median voter in the small region prefers unification then all other voters in the small region also prefer unification.[13] Thus the voters in the small region along with voters located between α and $1/2$ form a majority in favor of union and hence in favor of Rule II. Rule II therefore dominates Rule I for these cases.

We now compare Rules II and III. From Propositions 2.5.1 and 2.5.3 we deduce that if the outcome under Rule III is equal union then the same outcome obtains under Rule II. Similarly, if the outcome under Rule II is separation then the same outcome obtains under Rule III. So the only cases where the outcomes differ are those where there is unification under Rule II while the outcome under Rule III is unequal union or separation. There are two ways in which this can happen. In the first case voters in the small region prefer equal union over separation and separation over unequal union, while voters in the large region prefer separation over equal union. In the second case voters in the small region prefer equal union over unequal union and unequal union over separation. In the first case the outcome under Rule III will be separation. We can use the same argument we have used above (in comparing Rules I and II) to show that a majority of the individuals prefers Rule II over Rule III. In the latter case the outcome will be unequal union under Rule III. The individuals in the small region prefer equal union over unequal union. The individuals located betwee α and $1/2$ also prefer union over unequal union. In an equal union they will pay the same taxes as in unequal union but they will be located closer to the government in an equal union. Thus a majority of voters prefers Rule II to Rule III, in all the cases where the outcome differs.

[13] If the median voter in a region prefers union over separation then all individuals in the region will have this preference, since utility is decreasing with the same rate under union and separation with respect to distance.

The above arguments lead us to conclude that Rule II is enforceable for all parameters,[14] which is not the case for the other rules under consideration.

2.6 Concluding remarks

This chapter has examined incentives of regions to unite/separate in terms of a basic trade-off: separation allows for greater influence over the nature of political decision making while unification allows regions to exploit economies of scale in the provision of government. We find that if regions have dispersed preferences then a small region is relatively more eager to form a union as compared to a large region. However, the incentives of a large region to form a union are increasing with regard to clustering/concentration of preferences in the large region, while the reverse holds true for the small region. Our analysis also identifies the important role of regional location in shaping preferences over unification and separation.

We then explore the social welfare of decisions made on the basis of majority voting in regions. Our main finding is that majority voting rules typically lead to excessive separation. A discussion of alternative voting systems reveals that a majority voting system supplemented with unification as a default option is normatively appealing as well as enforceable.

There are several directions in which our model can be developed further. First, we have examined a variety of political rules and also discussed their stability. There is another dimension to the stability question. There may be groups of persons who are unhappy with the outcome under majority voting and they may use violent means to have their way. This raises the question: to what extent are the outcomes robust to attempts by the disaffected group to secede or forcibly unite? We feel that these issues, while clearly important, require a model in which costs of violence as well as the technology of suppression of violence are explicitly formulated and therefore lie outside the scope of this Chapter. The interplay of violence and secessionism is discussed in Chapter 6. Second, we have assumed that the public good/government is indivisible and has a fixed level and cost. Typically, public goods permit some decentralization and voters decide on the level of the public good to some extent. A model relaxing the fixed costs assumption is discussed in Chapter 4. Third, we have assumed that public goods have no spillovers across regional/national boundaries. In many cases of interest, public goods have spillovers and, moreover, these spillovers are related to the location of different individuals. The effect of positive spillovers is discussed, in a somewhat different setting, in Chapter 5.

2.7 Appendix A.

Proof of Proposition 2.3.3: In the socially optimal solution the sum of all individual utilities is maximized. If it is optimal to have just one country, then it will be socially optimal to choose the location of the public good and the tax level to maximize the

[14] Our arguments above also establish that Rule II is self-stable in the sense of Barbera and Jackson (2000).

aggregate payoff U_I to all individuals in the union:

$$U_I = \int_0^1 U_I(i)di = g(1 - aE(d_i|l)) + y - E(t_i) \tag{2.14}$$

and if it is optimal to form two governments then it will be socially optimal to choose the location of the public good and the tax level to maximize the aggregate payoff U_{II} to all individuals under separation:

$$U_{II} = \int_0^1 U_{II}(i)di = \sum_{x=A,B} s_x[g(1 - aE_x(d_i|l_x)) + y - E_x(t_i)] \tag{2.15}$$

where $E_x(d_i|l_x)$, s_x and $E_x(t_i)$ are, respectively, the average distance in country x given the location of the government, the size of country x and the lump sum tax level in country x. Since the value of α is exogenously specified, the values of s_A and s_B are α and $1 - \alpha$, respectively. In order to minimize $E_x(d_i)$ it is socially optimal to locate the government in the middle of each country. Hence, $E_A(d_i)$, $E_B(d_i)$ and $E(d_i)$ are, respectively, $\alpha/4$, $(1 - \alpha)/4$ and $1/4$. Each country has to finance its own government, therefore $E_A(t_i)$, $E_B(t_i)$ and $E(t_i)$ are, respectively, F/α, $F/(1 - \alpha)$ and F.
Hence, the social utility expressions (2.14) and (2.15) can be rewritten as follows:

$$U_I = g(1 - \frac{a}{4}) + y - F \tag{2.16}$$

$$U_{II} = \alpha[g(1 - a\frac{\alpha}{4})] + (1 - \alpha)[g(1 - a\frac{1 - \alpha}{4})] + y - 2F \tag{2.17}$$

Comparing the total utilities of unification and separation determines the choice for either unification or separation. It is better to have one government (one nation) if and only if $U_I > U_{II}$:

$$g(1 - \frac{a}{4}) + y - F > \alpha[g(1 - a\frac{\alpha}{4})] + (1 - \alpha)[g(1 - a\frac{1 - \alpha}{4})] + y - 2F \tag{2.18}$$

After rearranging terms, this inequality can be written as

$$\frac{ga}{2}\alpha^2 - \frac{ga}{2}\alpha + F > 0 \tag{2.19}$$

and this is equivalent with

$$\alpha^2 - \alpha + \frac{2F}{ga} > 0 \tag{2.20}$$

Note that this inequality will only have solutions if $F < ga/8 = F_{SP}$.
Inequality (2.18) is satisfied for values of α when:

$$\alpha < \frac{1}{2} - \sqrt{\frac{1}{4} - \frac{2F}{ga}} \tag{2.21}$$

or when

$$\alpha > \frac{1}{2} + \sqrt{\frac{1}{4} - \frac{2F}{ga}} \tag{2.22}$$

Note that the right hand side of inequality (2.22) is greater than 1/2. Because α is, by assumption, smaller than 1/2, we can omit inequality (2.22). This proves Proposition 2.3.3. □

Formal Analysis for symmetric case: A coalition $\mathcal{C}$ is a subset of the set of regions $N = \{A, B, C\}$. An outcome specifies which, if any, subset of regions unites and which of the regions remain independent. Let $\mathcal{S}$ be the set of possible outcomes and let $s \in \mathcal{S}$ be a typical outcome in this set. Also denote by u_i^s the utility of the median voter in region i, under outcome s. Likewise, let $u_i^{\mathcal{C}}$ be the utility that accrues to the median voter of region i, in a coalition $\mathcal{C}$. A coalition is said to block an outcome s if $u_i^{\mathcal{C}} \geq u_i^s$, for all $i \in \mathcal{C}$ and there is some $i \in \mathcal{C}$ such that $u_i^{\mathcal{C}} > u_i^s$. An outcome is said to be stable (or to lie in the core) if there exists no blocking coalition.
We shall use the & sign to denote a union between two regions. We summarize the results of our analysis in the following Proposition. Let $\alpha_1 = \frac{1}{2} - \frac{1}{2}\sqrt{1 - \frac{8F}{ga}}$, $\alpha_2 = \frac{2F}{ga}$, $\alpha_3 = 1 - \frac{2F}{ga}$ and $\alpha_{\mathcal{C}} = \frac{3}{4} - \frac{1}{4}\sqrt{1 + \frac{16F}{ga}}$.

Proposition 2.7.1.

1. *If $0 < F < \frac{1}{9}ga$ then (a) for all $\alpha \in [0, \alpha_2]$ the stable outcome is A&B&C; (b) for all $\alpha \in [\alpha_2, \frac{1}{2}]$ the stable outcome is A, B, C;*

2. *If $\frac{1}{9}ga < F < \frac{1}{8}ga$ then (a) for all $\alpha \in [0, \alpha_2]$ the stable outcome is A&B&C; (b) for all $\alpha \in [\alpha_2, \alpha_C]$ the stable outcome is A, B, C; (c) for all $\alpha \in [\alpha_C, \alpha_1]$ the stable outcome is either $A\&C, B$ or $A, B\&C$; (d) for all $\alpha \in [\alpha_1, \frac{1}{2}]$ the stable outcome is A, B, C.*

3. *If $\frac{1}{8}ga < F < (\frac{1}{2} - \frac{1}{4}\sqrt{2})ga$ then (a) for all $\alpha \in [0, \alpha_2]$ the stable outcome is A&B&C; (b) for all $\alpha \in [\alpha_2, \alpha_C]$ the stable outcome is A, B, C; (c) for all $\alpha \in [\alpha_C, \frac{1}{2}]$ the stable outcome is either $A\&C, B$ or $A, B\&C$.*

4. *If $(\frac{1}{2} - \frac{1}{4}\sqrt{2})ga < F < \frac{1}{4}ga$ then (a) for all $\alpha \in [0, \alpha_C]$ the stable outcome is A&B&C; (b) for all $\alpha \in [\alpha_C, \alpha_2]$ the stable outcome is either $A\&C, B$, $A, B\&C$ or A&B&C; (c) for all $\alpha \in [\alpha_2, \frac{1}{2}]$ the stable outcome is either $A\&B, C$ or $A, B\&C$.*

5. *If $\frac{1}{4}ga < F < \frac{1}{2}ga$ then (a) for all $\alpha \in [0, \alpha_C]$ the stable outcome is A&B&C; (b) for all $\alpha \in [\alpha_C, \alpha_3]$ the stable outcome is either $A\&C, B$, $A, B\&C$ or A&B&C; (c) for all $\alpha \in [\alpha_3, \frac{1}{2}]$ the stable outcome is A&B&C.*

6. *If $F > \frac{1}{2}ga$ then for all $\alpha \in [0, \frac{1}{2}]$ the stable outcome is A&B&C.*

Proof: First, note that for all parameter values, the central region, region C, will prefer a union with the two other regions over all other possibilities. Secondly, note that the preferences over unification and separation for the two regions at the endpoints of the interval are essentially the same. Both regions have the same size as well as a 'similar' location.
A majority of the individuals in the central region prefer a union with one of the regions over independence if

$$U_{A\&C}(\frac{1}{2}) = U_{B\&C}(\frac{1}{2}) = g(1 - \frac{a\alpha}{2}) + y - \frac{F}{1-\alpha} > g + y - \frac{F}{1-2\alpha} = U_C(\frac{1}{2}) \qquad (2.23)$$

That is, if $\alpha < \frac{3}{4} + \frac{1}{4}\sqrt{1 + \frac{16F}{ga}}$ or if $\alpha > \frac{3}{4} - \frac{1}{4}\sqrt{1 + \frac{16F}{ga}}$. Since α has to be less than $\frac{1}{2}$ and $\frac{3}{4} + \frac{1}{4}\sqrt{1 + \frac{16F}{ga}} > \frac{1}{2}$ the relevant inequality is

$$\alpha > \frac{3}{4} - \frac{1}{4}\sqrt{1 + \frac{16F}{ga}} = \alpha_C \tag{2.24}$$

Similar comparisons of utility levels yield that a majority of the individuals in region A (and therefore also a majority of the individuals in region B) prefer a union with region C if

$$\alpha > \frac{1}{2} - \frac{1}{2}\sqrt{1 - \frac{8F}{ga}} = \alpha_1 \tag{2.25}$$

Note that this implies that $F < \frac{ga}{8}$. A majority of the individuals in region A (region B) prefers independence over a union with the two other regions if

$$\alpha > \frac{2F}{ga} = \alpha_2 \tag{2.26}$$

and a union with three regions over a union with just the central region if

$$\alpha > 1 - \frac{2F}{ga} = \alpha_3 \tag{2.27}$$

To determine the ordering of α_1, α_2, α_3, α_C, and $\frac{1}{2}$ we compare pairwise the six values and we get the following. For $0 < F < \frac{ga}{9}$, $0 < \alpha_2 < \alpha_1 < \alpha_C < \frac{1}{2} < \alpha_3$. For $\frac{ga}{9} < F < \frac{ga}{8}$, $0 < \alpha_2 < \alpha_C < \alpha_1 < \frac{1}{2} < \alpha_3$. For $\frac{ga}{8} < F < (\frac{1}{2} - \frac{1}{4}\sqrt{2})ga$, $0 < \alpha_2 < \alpha_C < \frac{1}{2} < \alpha_3$. For $(\frac{1}{2} - \frac{1}{4}\sqrt{2})ga < F < \frac{ga}{4}$, $0 < \alpha_C < \alpha_2 < \frac{1}{2} < \alpha_3$. For $\frac{ga}{4} < F < \frac{ga}{2}$, $0 < \alpha_C < \alpha_3 < \frac{1}{2} < \alpha_2$. For $F > \frac{ga}{2}$, $\alpha_3 < \alpha_C < 0 < \frac{1}{2} < \alpha_2$. The combination of these relations, of the inequalities (2.24)-(2.27), and the stability requirements mentioned above gives us the required result. □

Formal Analysis of regional incentives in asymmetric case: We shall use & to denote a union between two regions and the notation $\succ$ to denote 'preferred under majority voting'. We summarize the results of our analysis of majority voting in the central region C in the following Proposition. We define $\alpha_1 = \frac{1}{20} + \frac{1}{2}\sqrt{\frac{1}{100} + \frac{8F}{ga}}$, $\alpha_2 = \frac{20}{9}\frac{F}{ga} + \frac{1}{10}$ and $\alpha_3 = \frac{20}{9}\frac{F}{ga}$.

Proposition 2.7.2.

1. *If $0 < F < \frac{9}{200}ga$ then (a) for all $\alpha \in [\frac{1}{10}, \alpha_2]$, $C\&A \succ C\&B \succ C$; (b) for all $\alpha \in [\alpha_2, \alpha_1]$, $C\&A \succ C \succ C\&B$; (c) for all $\alpha \in [\alpha_1, \frac{9}{10}]$, $C \succ C\&A \succ C\&B$; (d) for all $\alpha \in [\frac{9}{10}, 1]$, $C \succ C\&B \succ C\&A$.*

2. *If $\frac{9}{200}ga < F < \frac{72}{200}ga$ then (a) for all $\alpha \in [\frac{1}{10}, \alpha_3]$, $C\&B \succ C\&A \succ C$; (b) for all $\alpha \in [\alpha_3, \alpha_2]$, $C\&A \succ C\&B \succ C$; (c) for all $\alpha \in [\alpha_2, \alpha_1]$, $C\&A \succ C \succ C\&B$; (d) for all $\alpha \in [\frac{9}{10}, 1]$, $C \succ C\&B \succ C\&A$.*

3. *If $\frac{72}{200}ga < F < \frac{81}{200}ga$ then (a) for all $\alpha \in [\frac{1}{10}, \alpha_3]$, $C\&B \succ C\&A \succ C$; (b) for all $\alpha \in [\alpha_3, \frac{9}{10}]$, $C\&A \succ C\&B \succ C$; (c) for all $\alpha \in [\frac{9}{10}, \alpha_1]$, $C\&B \succ C\&A \succ C$; (d) for all $\alpha \in [\alpha_1, \alpha_2]$, $C\&B \succ C \succ C\&A$; (e) for all $\alpha \in [\alpha_2, 1]$, $C \succ C\&B \succ C\&A$.*

4. *If* $\frac{81}{200}ga < F < \frac{90}{200}ga$ *then (a) for all* $\alpha \in [\frac{1}{10}, \frac{9}{10}]$, $C\&B \succ C\&A \succ C$; *(b) for all* $\alpha \in [\frac{9}{10}, \alpha_3]$, $C\&A \succ C\&B \succ C$; *(c) for all* $\alpha \in [\alpha_3, \alpha_1]$, $C\&B \succ C\&A \succ C$; *(d) for all* $\alpha \in [\alpha_1, 1]$, $C\&B \succ C \succ C\&A$.

5. *If* $F > \frac{90}{200}ga$ *then (a) for all* $\alpha \in [\frac{1}{10}, \frac{9}{10}]$, $C\&B \succ C\&A \succ C$; *(b) for all* $\alpha \in [\frac{9}{10}, 1]$, $C\&A \succ C\&B \succ C$.

Proof: A majority of the individuals in region C will prefer independence over a union with region A if the utility of the median voter is larger under independence than in a union with region A:

$$U_I(\frac{1}{20} + \frac{1}{2}\alpha) = g + y - \frac{F}{\alpha - \frac{1}{10}} > g(1 - a|\frac{1}{20}|) + y - \frac{F}{\alpha} = U_{C\&A}(\frac{1}{20} + \frac{1}{2}\alpha) \tag{2.28}$$

That is, if

$$\alpha^2 - \frac{1}{10}\alpha - \frac{2F}{ga} > 0 \tag{2.29}$$

This inequality is satisfied if $\alpha < \frac{1}{20} - \frac{1}{2}\sqrt{100 + \frac{8F}{ga}}$ or if $\alpha > \frac{1}{20} + \frac{1}{2}\sqrt{100 + \frac{8F}{ga}}$. Since $\frac{1}{20} - \frac{1}{2}\sqrt{100 + \frac{8F}{ga}} < 0$ the relevant inequality is

$$\alpha > \frac{1}{20} + \frac{1}{2}\sqrt{100 + \frac{8F}{ga}} = \alpha_1 \tag{2.30}$$

Similar comparisons of utility levels yield that a majority of individuals in region C will prefer independence over a union with region B if

$$\alpha > \frac{1}{20}\frac{F}{ga} + \frac{1}{10} = \alpha_2 \tag{2.31}$$

and a union with region A over a union with region C if

$$\alpha > \frac{1}{20}\frac{F}{ga} = \alpha_3 \tag{2.32}$$

To determine the ordering of 1/10, 9/10, 1, α_1, α_2 and α_3 we compare pairwise the six values and we get the following: For $0 < F < 9/200ga$, $1/10 < \alpha_2 < \alpha_1 < 9/10$. For $9/200 < F < 72/200ga$, $1/10 < \alpha_3 < \alpha_2 < \alpha_1 < 9/10$. For $72/200 < F < 81/200ga$, $1/10 < \alpha_3 < 9/10 < \alpha_1 < \alpha_2 < 1$. For $81/200 < F < 90/200ga$, $1/10 < \alpha_3 < 9/10 < \alpha_1 < \alpha_2 < 1$. The combination of these relations and of the inequalities (2.30)-(2.32) gives us the result. □

Proof of Proposition 2.5.2: A majority in each region in favor of separation implies that there is a majority in the whole nation, so the proof of the if-part of the statement is immediate. The only if-part of the statement is equivalent to: *if there does not exist a majority in favor of separation in both regions then there does not exist a majority in favor of separation in the whole nation.* There are three different cases in which there does not exist a majority in favor of separation in both regions:

Case $\mathcal{A}$ There exist a majority in favor of separation in region A but not in region B.
Case $\mathcal{B}$ There exists a majority in favor of separation in region B but not in region A.
Case $\mathcal{C}$ There exists a majority in favor of separation in neither region B nor in region A.
In case $\mathcal{C}$ it is straightforward to see that there does not exist a majority in favor of separation in the whole nation.
We now take up cases $\mathcal{A}$ and $\mathcal{B}$. The following formulae are useful in what follows:

$$U_{II}(\frac{1}{2}) = g - \frac{1}{2}ga\alpha + y - \frac{F}{1-\alpha} < g + y - F = U_I(\frac{1}{2}) \tag{2.33}$$

From Proposition 2.3.1, we know that case $\mathcal{A}$ implies that:

$$U_{II}(\frac{1+\alpha}{2}) < U_I(\frac{1+\alpha}{2}). \tag{2.34}$$

We also know that

$$\frac{\partial U_I(i)}{\partial i} = -ga, \qquad \forall i \in [\frac{1}{2}, 1], \tag{2.35}$$

which implies that $U_I(i)$ is decreasing in $i \in [1/2, (1+\alpha)/2]$. Furthermore,

$$\frac{\partial U_{II}(i)}{\partial i} = ga, \qquad \forall i \in [\alpha, \frac{1+\alpha}{2}], \tag{2.36}$$

which implies that $U_{II}(i)$ is increasing in $i \in [1/2, (1+\alpha)/2]$. Finally, we note that,

$$\frac{\partial U_{II}(i)}{\partial i} = -ga, \qquad \forall i \in [\frac{1+\alpha}{2}, 1]. \tag{2.37}$$

This implies that $U_{II}(i)$ is decreasing in $i \in [(1+\alpha)/2, 1]$.
From expressions (2.34), (2.35) and (2.36) it follows that $U_{II}(i) < U_I(i)$ for all $i \in [1/2, (1+\alpha)/2]$ and from expressions (2.34), (2.35) and (2.37) it follows that $U_{II}(i) < U_I(i)$ for all $i \in [(1+\alpha)/2, 1]$, so $U_{II}(i) < U_I(i)$ for all $i \in [1/2, 1]$. Inequality (2.33) and the continuity of the utility function in i imply that the individuals sufficiently close to $1/2$ prefer unification. Hence, there does not exist a majority in favor of separation in case $\mathcal{A}$.
Using Proposition 2.3.1, we know that case $\mathcal{B}$ implies that:

$$U_{II}(\frac{\alpha}{2}) < U_I(\frac{\alpha}{2}). \tag{2.38}$$

We also know that

$$\frac{\partial U_I(i)}{\partial i} = ga, \qquad \forall i \in [0, \frac{1}{2}], \tag{2.39}$$

which implies that $U_I(i)$ is increasing in $i \in [0, 1/2]$. Furthermore,

$$\frac{\partial U_{II}(i)}{\partial i} = ga, \qquad \forall i \in [0, \frac{\alpha}{2}], \tag{2.40}$$

so $U_{II}(i)$ is increasing in $i \in [0, \alpha/2]$. We next note that,

$$\frac{\partial U_{II}(i)}{\partial i} = -ga, \qquad \forall i \in [\frac{\alpha}{2}, \alpha], \tag{2.41}$$

so $U_{II}(i)$ is decreasing in $i \in [\alpha/2, \alpha]$. Finally, note that

$$\frac{\partial U_{II}(i)}{\partial i} = ga \qquad \forall i \in [\alpha, \frac{\alpha+1}{2}] \tag{2.42}$$

so $U_{II}(i)$ is increasing in $i \in [\alpha, 1/2]$.
From expressions (2.38), (2.39) and (2.40) it follows that $U_{II}(i) < U_I(i)$ for all $i \in [0, \alpha/2]$, from expressions (2.38), (2.39) and (2.41) it follows that $U_{II}(i) < U_I(i)$ for all $i \in [\alpha/2, \alpha]$ and from expressions (2.33), (2.39) and (2.42) it follows that $U_{II}(i) < U_I(i)$ for all $i \in [\alpha, 1/2]$, so $U_{II}(i) < U_I(i)$ for all $i \in [0, 1/2]$. Inequality (2.33) and the continuity of the utility function in i imply that the individuals sufficiently close to the individual located at $1/2$ prefer unification. Hence there does not exist a majority in favor of separation in the whole nation, which proves case $\mathcal{B}$. □

2.8 Appendix B.

It is widely argued that wealth and income differences are on the main factors behind regional movements which seek secession. One of the assumptions in the basic model is that the initial endowment per individual is equal in both regions. To study wealth differences across regions we write the initial endowment of the individuals in region A and in region B as y_A and y_B, respectively. We suppose that these incomes differ by a factor θ, $\theta > 0$, and we write $y_B = \theta y_A$. It can be verified that wealth differences do not matter when the public good is financed by lump sum taxes. We therefore change the system of taxation to proportional taxes. When both regions separate there are different tax levels in each region and when there is union we have just one tax level to finance the public good. One justification for this assumption is that a difference in tax-levels between the regions is not sustainable when the subject of taxation (e.g. capital or labor) is mobile in a union. If there exists a tax difference between the regions in a union then the capital or the labor will be located in the region with the lowest tax level. It is also possible that the legislation of a union allows just one tax rate. This leads to three proportional tax levels: t_A denotes the tax level under separation in region A, t_B the same in region B and t denotes the proportional tax level in a union. Recall that Proposition 2.3.2 tells us that there exists an α_A such that region A prefers unification if and only if $\alpha \in (0, \alpha_A)$ and there exists an α_B such that region B prefers unification if and only if $\alpha \in (\alpha_B, 1/2)$.

Proposition 2.8.1. *When θ increases, α_A and α_B will increase. For $\theta > 8F/(8F - ga)$ region A always prefers union and for $\theta < (8F - ga)/8F$ region B always prefers union.*

This Proposition is in line with the idea that it is more attractive to unite with a rich region than with a poor region: An increase in θ implies that the individuals in region B become relatively richer compared to the individuals in region A. Union becomes therefore more attractive for region A and less attractive for the individuals in region B, which is reflected by the increases in α_A and α_B, respectively.
Proof of Proposition 2.8.1: Note that we can use Proposition 2.3.1 in this proof. We will prove that an increase in θ leads to an increase in α_A. The proof that an increase in θ leads to an increase in α_B has the same structure as in the α_A-case and it is therefore

not given. Recall that we restricted α to values between 0 and 1/2. The utility of individual $\alpha/2$ in a union is

$$U_I(\frac{\alpha}{2}) = g - \frac{ga}{2} + \frac{ga\alpha}{2} + y_A - \frac{F}{(\alpha + (1-\alpha)\theta)y_A} y_A \tag{2.43}$$

and under separation

$$U_{II}(\frac{\alpha}{2}) = g + y_A - \frac{F}{\alpha} \tag{2.44}$$

Let $U_I^\theta(\alpha)$ and $U_{II}^\theta(\alpha)$ be the utility of individual $\alpha/2$ under union and separation, respectively. Like in the standard model, define $\alpha_A(\theta)$ as

$$\begin{aligned} U_I^\theta(\alpha) < U_{II}^\theta(\alpha) \; for \; \alpha < \alpha_A(\theta) \\ U_I^\theta(\alpha) = U_{II}^\theta(\alpha) \; for \; \alpha = \alpha_A(\theta) \\ U_I^\theta(\alpha) > U_{II}^\theta(\alpha) \; for \; \alpha > \alpha_A(\theta) \end{aligned} \tag{2.45}$$

Hence, since $U_I^\theta(\alpha)$ and $U_{II}^\theta(\alpha)$ are differentiable in α for $\alpha \in (0, 1/2)$,

$$\frac{\partial[U_I^\theta(\alpha_A(\theta)) - U_{II}^\theta(\alpha_A(\theta))]}{\partial\alpha} < 0 \tag{2.46}$$

Next note that at $\alpha_A(\theta)$, $U_I^\theta(\alpha(\theta)) - U_{II}^\theta(\alpha(\theta)) = 0$. Hence,

$$\frac{\partial[U_I(\alpha_A(\theta)) - U_{II}(\alpha_A(\theta))]}{\partial\alpha} d\alpha + \frac{\partial[U_I(\alpha_A(\theta)) - U_{II}(\alpha_A(\theta))]}{\partial\theta} d\theta = 0 \tag{2.47}$$

This implies that

$$\frac{d\alpha_A(\theta)}{d\theta} = \frac{-\frac{\partial[U_I^\theta(\alpha_A(\theta)) - U_{II}^\theta(\alpha_A(\theta))]}{\partial\theta}}{\frac{\partial[U_I^\theta(\alpha_A(\theta)) - U_{II}^\theta(\alpha_A(\theta))]}{\partial\alpha}} \tag{2.48}$$

Note that $\partial U_{II}^\theta(\alpha_A(\theta))/\partial\theta = 0$

$$\frac{\partial U_I^\theta(\alpha)}{\partial\theta} = \frac{F(1-\alpha)}{(\alpha + (1-\alpha)\theta)^2} > 0 \tag{2.49}$$

and recall that

$$\frac{\partial[U_I^\theta(\alpha_A(\theta)) - U_{II}^\theta(\alpha_A(\theta))]}{\partial\alpha} < 0 \tag{2.50}$$

Hence $d\alpha_A(\theta)/d\theta > 0$. This completes the proof. □

Proposition 2.8.2. *The socially desirable outcome does not change when the endowments across regions vary.*

Proof: In a social optimum the sum of all individual utilities is maximized. The utility under union is

$$U_I = \int_0^1 U_I(i)di = \sum_{x=A,B} s_x[g(1 - aE(d_i|l)) + y_x - t_x y_x] \tag{2.51}$$

This implies that

$$U_I = g(1 - aE(d_i|l)) + y - \sum_{x=A,B} s_x t_x y_x = g(1 - \frac{a}{4}) + y - F \tag{2.52}$$

The utility under separation is

$$U_{II} = \int_0^1 U_{II}(i)di = \sum_{x=A,B} s_x[g(1 - aE(d_i|l)) + y_x - t_x y_x] \tag{2.53}$$

So total utility under separation can be written as

$$U_{II} = \alpha[g(1 - a\frac{\alpha}{4})] + (1 - \alpha)[g(1 - a\frac{1-\alpha}{4})] + y - 2F \tag{2.54}$$

These utilities are equal to the utilities of equations 2.16 and 2.17. We can therefore apply the same analysis as in the standard model. □

This Proposition implies that differences in initial endowments across regions are irrelevant for the socially optimal outcome in which aggregate utility is maximized. Moreover, the possibility of choosing different taxation systems for compensation or for wealth transfers does not influence the the socially desirable outcome.

Chapter 3

Unification and public good provision

3.1 Introduction

In the last 20 years, changes in boundaries attracted attention in the general press as well as in academic research. Some well known examples are the disintegration of the former Soviet Union and Yugoslavia. On the contrary, we have seen the German reunification and steps to further economic and monetary integration in Europe[1]. Academic researchers have found that majority voting induces excessive incentives for separation - see the discussion of the literature below-. In this chapter I develop a framework to study how the incentives for public good provision and the incentives for unification and separation are related.

In the model, I assume that there are two regions which can choose to separate and form two independent countries or to unite and form one country. Under separation, one type of the public good should be provided in a country. Individuals in a union, however, can choose to mimic something they could also achieve under separation, namely the provision of two types of the public good. In a union, the individuals can thus choose to provide one or two types of the public good. If there is disagreement between the two regions in the decision on unification then the two regions will separate. After those decisions, individuals in each political territory choose the type or location of the public good. This determines, for example, where the capitals, the main airports, the universities and other facilities are located. In this spirit, location choices may be interpreted geographically. The model also permits an interpretation in terms of individual preferences more general.[2] There is a fixed cost for each type of the public good provided. In case of separation, the

[1] See The Times Atlas [1993, Plate 8] for a survey map on border changes and changes in sovereignty since 1945 and Alesina, Spolaore and Wacziarg (2000) for more data on country formation since 1870.

[2] In the latter preference interpretation, individuals who are close to each other are assumed to have the same preferred type of public good. Public goods located far from individuals differ more from the preferred type of public good of these individuals than from the preferred type of public good of the individuals who are located in close proximity of the public good. One can for example think of cultural preferences. The people living close to the boundary then have a lower payoff than other individuals since they are far from the public good *and* since they prefer to have a different type of public good.

individuals in each country have to bear this cost of their public good separately. When there is a union, all individuals bear the costs of the public goods provided, independent of whether two or just one type of the public good is provided. This assumption generates the following trade-off [3]: separation allows individuals within a small region to exercise greater influence on political decision-making, while unification allows them to exploit economies of scale in the provision of public goods. The incentives for exercising greater influence are called incentives for separation and the exploitation of economies of scale are called incentives for unification. Individuals benefit from the public goods provided. The incentives to increase the amounts provided, either under unification or under separation, are called the incentives for public good provision. The novel insights this approach offers are how the incentives for separation and the incentives for public good provision are connected.

The fixed costs of providing public goods plays an important role in shaping the trade-off voters face. My finding is that for *high* fixed costs, unification only takes place between relatively similar sized regions. Since the costs of providing public goods are relatively high, individuals will choose to have only one type of the public goods in a union. This result arises out of the different ways in which the political costs of unification compare with the tax advantages. In particular, political costs of unification vary linearly with the size of the other region, while the tax advantages are increasing and (strictly) convex in the size of the other region. This implies that relative to the costs the gains from unification decline for the larger region as the small region becomes smaller. Thus large regions are reluctant to form unions. This is motivated by the incentives for separation as well as by the incentives for public good provision.
I find that for *low* fixed costs of providing public goods, on the contrary, separation takes place relatively similar sized regions. Since the costs of providing public goods is relatively low, individuals will choose to provide two types of the public good in a union. This result arises out of the same way costs and benefits of unification are compared as the way for relative high values of the fixed costs. Individuals in the large region, however, prefer separation to exert more influence on the type of public goods provided.

I next examine the social welfare implications of decisions made on the basis of these preferences. The main finding is that majority voting leads to excessive separation and excessive provision of public goods. For *low* fixed costs of providing public goods, it is optimal to provide two types of the public good and we observe excessive incentives for separation. For *intermediate* fixed costs, it is optimal to provide one type of the public good and we observe excessive incentives for public good provision along with excessive incentives for separation. When public good provision is costly, provision of one type of the public good is optimal as well as the majority voting outcome. The excessive incentives arise out of the way the costs and benefits of unification and public good provision are distributed. The costs in terms of higher per capita tax rates are borne equally by individuals in a region. On the other hand, the benefits from separation

[3]This trade-off as well as some other features are similar to the models presented in Alesina and Spolaore (1997) and Goyal and Staal (2003). I discuss the relationship of the model with these papers in detail below. Alesina and Wacziarg (1998) present empirical evidence that supports the existence of scale effects in the provision of public goods.

and from providing two types of the public good depend on an individual's location. Individuals located close to the boundary between the regions loose relatively more from separation while individuals away from the boundaries gain more from separation. When individuals choose to provide two types of public goods instead of one type, individuals located close to the type of the single public good will loose relatively more than others. The vote of an individual thus generates externalities on other voters; in particular, the analysis shows that voting tends to under-represent the interests of the voters which are losing from separation or from the provision of an additional type of the public good.

This chapter is a contribution to the study of the break-up and formation of nations. In recent years, there have been considerable interest in these issues, see e.g. Alesina and Spolaore (1997), Bolton and Roland (1997) and Goyal and Staal (2003).[4] This political economy work is related the local public good literature and the literature on fiscal federalism[5]. In particular, this chapter is closely related to the paper by Alesina and Spolaore (1997) and to the analysis presented in Chapter 2.

Alesina and Spolaore (1997) study the influence of different factors, such as the level of market integration and democratization, in determining the equilibrium number and sizes of countries. The economic advantages of unification are compared with the political costs of a public good which is located further away in a larger country. In this setting, they find that democratization leads to an inefficiently large number of countries. In the analysis, the boundaries between nations are endogenous and attention is restricted to equal sized countries. The analysis presented in Chapter 2 is based on the same trade-off as used be Alesina and Spolaore (1997). Separation allows for greater influence over the nature of political decision making while unification allows the exploitation of economies of scale in the provision of public goods. They study the influence of size, location, the diversity within regions and the role of political institutions in shaping this trade-off. An important assumption in the analysis mentioned above is that in a country only one type of the public good can be provided. In this chapter I relax this assumption by allowing individuals in a union to mimic the diversity of public goods provision under separation. Individuals can choose to provide two types of public goods in a union. For high values for the fixed costs of providing public goods the outcomes are identical to the outcomes found by Goyal and Staal (2003), but for low values they did not allow for the provision of two public goods in a union, which I find as the voting outcome. The contribution of this chapter is how the incentives for unification, separation and public good provision are related, which is especially interesting in the cases for moderate and low costs of public good provision.

The remainder of this chapter is organized as follows. In Section 2 I present the model. Section 3 presents the outcome under majority voting and Section 4 the socially optimal outcome. Section 5 concludes with a comparison of the two outcomes and with some more general comments.

[4]See Bolton, Roland and Spolaore (1996) for a more extensive review of the early literature.

[5]For the local public good theory, see Austin [1993], Benabou [1993], Bewley [1981], Epple and Romer [1991], Jehiel and Scotchmer [2003], Rubinfeld [1987], Scotchmer [1996], Stahl and Varaiya [1983] and Tiebout [1956]. For literature on fiscal federalism, see Oates [1972], Persson and Tabellini [2000] and Wildasin [1988].

3.2 The model

Suppose that different types of public goods can be provided. The range of all possible types of the public good is normalized in the segment $[0, 1]$. The type of the public good is denoted by l. In addition, assume that the total population has mass one and that individuals from this population are located at ideal points, which indicate their type of the public good. The individuals are uniformly distributed on the segment $[0, 1]$. The utility of each individual is decreasing with the distance from his public good to his location (i.e. his ideal point).

Assume that there are two regions with a fixed (exogenous) boundary α and that the two regions can form one or two nations, or "countries". The region located on the left-hand side of α is called region A, while the region on the right-hand side of α is called region B. Without loss of generality, suppose that $0 < \alpha < 1/2$. I assume that there is a fixed cost F per public good. This F includes for example the costs of building airports and hospitals and the costs of having a machinery of government. Every individual has the same exogenous income y, and pays the lump-sum tax t_i.[6] Now, we can define the utility function for each individual i as follows:

$$U(i) = g(1 - ad_i) + y - t_i \tag{3.1}$$

where g and a are two positive parameters. The parameter g measures the utility of the public good when the preference distance d_i is zero and the parameter a measures the loss in utility if the public good is farther away (i.e. when d_i increases). The preference distance d_i is the difference between the location of individual i and the location of the *closest* public good in the country where individual i is located. The utility function is thus linear in the preference distance. I assume that $a < 1$, which ensures that a higher g increases utility. The marginal utility of the public good located at a distance d_i is then equal to $1 - ad_i$.

I look at the incentives for separation and unification under majority voting. Separation occurs if a majority of voters is in favor of separation in at least one region.[7] In this case one of the public goods has to be located in the small region and the other in the large region. The individuals also have the option to have two public goods in a union. In that case they are free to choose any pair of locations they want. Finally the individuals can choose to have a union with one public good.

Under majority voting, decisions are thus taken in three stages. In the first stage individuals decide how many countries they want to have. If a majority of the individuals in a region prefers to have two nations over one nation the individuals will decide where

[6] Proportional taxation with different tax levels across regions is not sustainable when the subject of taxation (e.g. capital or labor) is mobile in a union. In the model with exogenous income levels which are equal across the regions lump-sum taxation is equivalent to proportional taxation. I assume that individual wealth is equal in the two regions.

[7] This voting rule is realistic when the central government is too weak or does not want to prevent secession through military means. The disintegration of the former Soviet Union, for example, took place after the central government could not prevent secessions. The recent referendum in East Timor is another example of this procedure.

they want to locate the public goods but if majorities of the individuals in each region prefer to form a union then in the second stage the individuals will decide whether they want to have one or two public goods. In the third stage individuals decide where they want to locate the public good(s).

3.3 Majority voting

In this section I examine the outcomes when the decision to form one country with one or two public goods or two countries is taken by majority voting. The decision on the locations of the public goods is studied before the decision on unification and separation.

The decision on the location of the two public goods in one nation: Consider the locations of the public goods when individuals prefer to have a union with two public goods. Define $X = \{x_1, x_2\}$ as a pair of two locations for the two public goods and define $\bar{X} = \{1/4, 3/4\}$.

Lemma 3.3.1. *$\bar{X}$ is preferred by a majority in a nation-wide referendum to any other pair of locations for the two public goods.*

Proof: Assume, without loss of generality, that $x_1 < x_2$. All the possible deviations from $\bar{X}$ are captured in the following cases:
$\mathcal{I}$ $\{0 < x_1 < 1/4, x_2 = 3/4\}$ or $\{x_1 = 1/4, 3/4 < x_2 < 1\}$
$\mathcal{II}$ $\{1/4 < x_1 < 3/4, x_2 = 3/4\}$ or $\{x_1 = 1/4, 1/4 < x_2 < 3/4\}$
$\mathcal{III}$ $\{0 < x_1 < 1/4, x_1 < x_2 < 3/4\}$ or $\{1/4 < x_1 < x_2, 3/4 < x_2 < 1\}$
$\mathcal{IV}$ $\{0 < x_1 < 1/4, 3/4 < x_2 < 1\}$
$\mathcal{V}$ $\{1/4 < x_1 < x_2, x_1 < x_2 < 3/4\}$

In all cases, there are two public goods. The tax burden will therefore be the same in all cases. In the decision where to locate the two public goods we can therefore focus on the distance between the location of the public good located closest to an individual and the location of this individual. An individual will prefer a set of locations of two public goods over another set of locations if the distance to the public good is smaller.
Case $\mathcal{I}$: Let $X_{\mathcal{I}} = \{0 < x_1 < 1/4, x_2 = 3/4\}$ denote a pair of two locations for the two public goods. Individuals in the interval $(1/2, 1)$ are indifferent between $\bar{X}$ and $X_{\mathcal{I}}$. The individuals in the interval $(0, \frac{x_1+1/4}{2})$ are in favor of $X_{\mathcal{I}}$, but the individuals in $(\frac{x_1+1/4}{2}, 1/2)$ are in favor of $\bar{X}$. Since $x_1 > 1/4$ there is thus a majority in favor of $\bar{X}$. A similar argument applies to $\{x_1 = 1/4, 3/4 < x_2 < 1\}$.
Case $\mathcal{II}$: Let $X_{\mathcal{II}} = \{1/4 < x_1 < 3/4, x_2 = 3/4\}$ denote a pair of two locations for the two public goods. Individuals in the interval $(\frac{x_1+3/4}{2}, 1)$ are indifferent between $\bar{X}$ and $X_{\mathcal{II}}$. The individuals in $(0, \frac{1/4+x_1}{2})$ are in favor of $\bar{X}$, but the individuals in $(\frac{1/4+x_1}{2}, \frac{x_1+3/4}{2})$ are in favor of $X_{\mathcal{II}}$. Since $x_1 > 1/4$ there is thus a majority in favor of $\bar{X}$. A similar argument applies to $\{x_1 = 1/4, 1/4 < x_2 < 3/4\}$.
Case $\mathcal{III}$: Let $X_{\mathcal{III}} = \{0 < x_1 < 1/4, x_1 < x_2 < 3/4\}$ denote a pair of two locations for the two public goods. Individuals in the interval $(\frac{x_2+3/4}{2}, 1)$ are in favor of $\bar{X}$, likewise the

individuals in the interval $(\frac{x_1+1/4}{2}, \frac{1/4+x_2}{2})$ prefer $\bar{X}$ over $X_{\mathcal{III}}$. Thus, in total

$$1 - \frac{x_2 + 3/4}{2} + \frac{1/4 + x_2}{2} - \frac{x_1 + 1/4}{2} = \frac{5/4 - x_1}{2} \tag{3.2}$$

This is more than 1/2 since $x_1 < 1/4$. Hence, there is a majority in favor of $\bar{X}$. A similar argument applies to $\{1/4 < x_1 < x_2, 3/4 < x_2 < 1\}$.
Case $\mathcal{IV}$: Let $X_{\mathcal{IV}} = \{0 < x_1 < 1/4, 3/4 < x_2 < 1\}$ denote a pair of two locations for the two public goods. Individuals in the interval $(\frac{x_1+1/4}{2}, \frac{3/4+x_2}{2})$ are in favor of $\bar{X}$. Since $x_1 < 1/4$ and $x_2 > 3/4$ it follows that a majority prefers $\bar{X}$ over $X_{\mathcal{IV}}$.
Case $\mathcal{V}$: Let $X_{\mathcal{V}} = \{1/4 < x_1 < x_2, x_1 < x_2 < 3/4\}$ denote a pair of two locations for the two public goods. Individuals in the interval $(0, \frac{1/4+x_1}{2})$ and $(\frac{x_2+3/4}{2}, 1)$ are in favor of $\bar{X}$. Since $x_1 > 1/4$ and $x_2 < 3/4$ it follows that a majority prefers $\bar{X}$ over $X_{\mathcal{V}}$. □

It follows from the median-voter theorem that in a union with one public good the public good will be located at 1/2. Likewise in case of two nations the two public goods will be located in the center of each nation, respectively.

The decision to have one or two public goods: Now examine the incentives of a nation to have one or two public goods. If public goods are cheap there will be two public goods, otherwise there will be one public good. This is formally stated in the following lemma.

Lemma 3.3.2. *In a nationwide referendum a majority of the individuals will prefer to have one public good over two public goods if and only if $F > ga/4$.*

Proof: The individuals at 1/4 and 3/4 are the median voters.[8] Due to the symmetry in the model, it suffices to check the preferences of one of the two. The individual at 1/4 prefers one public good over two public goods if and only if $U_{1PG}(1/4) > U_{2PG}(1/4)$:

$$g(1 - \frac{1}{4}a) - F + y > g - 2F + y \tag{3.3}$$

Hence, a majority of the voters prefers to have a union with one public good over a union with two public goods when $F > ga/4$. □

Preferences over unification and separation in the small region: First observe that if α is very small then the per capita cost of supporting an independent public good, F/α, becomes very large and the individuals in the small region will therefore benefit significantly from unification. Next observe that in a union with two public goods the individuals in the small region will be located closer to the public good than in a union with only one public good. The analysis of these issues is summarized in the following lemma.

Lemma 3.3.3. *If $F < ga/4$ then a majority of the individuals in the small region prefers unification for all $\alpha < 4F/ga$. If $F > ga/4$ then a majority of the individuals in the small region prefers unification for all $\alpha < 2F/ga$.*

[8] It is straightforward to check that if the individual at 1/4 prefers a union with two public goods then all voters in the intervals $[0, 1/4]$ and $[3/4, 1]$ prefer a union with two public goods and that if the individual at 1/4 prefers a union with one public good then all voters in the interval $[1/4, 3/4]$ prefer a union with one public good.

Proof: If $F < ga/4$ then there will be two public goods located at $\{1/4, 3/4\}$ in a union. In the small region the median voter is located at $\alpha/2$. The median voter will prefer unification over independence if and only if his utility in a union, U_{2PG}, is larger than his utility under separation, U_{II}:

$$U_{2PG}(\frac{\alpha}{2}) = g(1 - a|\frac{1}{4} - \frac{\alpha}{2}|) - 2F + y > g - \frac{F}{\alpha} + y = U_{II}(\frac{\alpha}{2}) \tag{3.4}$$

That is, if $\alpha < 4F/ga$.
If $F > ga/4$ then there will be one public good located at $1/2$ in a union. Moreover, there is a majority in favor of unification in the small region if and only if the median voter $\alpha/2$ prefers unification:

$$U_{1PG}(\frac{\alpha}{2}) = g(1 - a|\frac{1}{2} - \frac{\alpha}{2}|) - F + y > g - \frac{F}{\alpha} + y = U_{II}(\frac{\alpha}{2}) \tag{3.5}$$

That is, if $\alpha < 2F/ga$. □

Preferences over unification and separation in the large region: The individuals in the large region also compare the benefit of a lower tax rate with the change in the location of the public good.

Lemma 3.3.4. *If $F < ga/4$ then a majority of the individuals in the large region prefers unification for all $\alpha < 1 - 4F/ga$. If $F > ga/4$ then a majority of the individuals in the large region prefers unification for all $\alpha > 1 - 2F/ga$.*

Proof: First consider the case of $F > ga/4$. There will be a single public good in case of unification. There is a majority in favor of unification in the large region if the median voter $(1 + \alpha)/2$ prefers unification:

$$U_{II}(\frac{1+\alpha}{2}) = g + y - \frac{F}{1-\alpha} < g(1 - a\frac{\alpha}{2}) + y - F = U_I(\frac{1+\alpha}{2}) \tag{3.6}$$

That is, if $\alpha > 1 - 2F/ga$.
Consider now the case of $F < ga/4$. In case of unification there will now be two public goods located at $1/4$ and $3/4$. In this case we cannot apply the median voter theorem directly to determine the voting outcome on a union with two public goods versus separation. Instead of looking at the preferences of a median voter I will first look at the preferences of the voters at $(1 + \alpha)/2$ and $3/4$. There are four possibilities: $(\mathcal{A})$ both voters prefer separation, $(\mathcal{B})$ both prefer unification, $(\mathcal{C})$ $(1+\alpha)/2$ prefers unification and $3/4$ prefers separation or $(\mathcal{D})$ $(1 + \alpha)/2$ prefers separation and $3/4$ prefers unification. The individual at $(1 + \alpha)/2$, however, will always prefer separation over unification since he pays more tax in a union but the public good is located farther away. We therefore do not need to pay attention to the cases $(\mathcal{B})$ and $(\mathcal{C})$: they are impossible.

A look at Figure 3.1 shows the following.
In a union utility is decreasing with respect to location for the individuals in $(1/4, 1/2)$ and $(3/4, 1)$, while for the individuals in $(0, 1/4)$ and $(1/2, 3/4)$ utility is increasing with respect to location. Analogously, utility under separation is decreasing with respect to

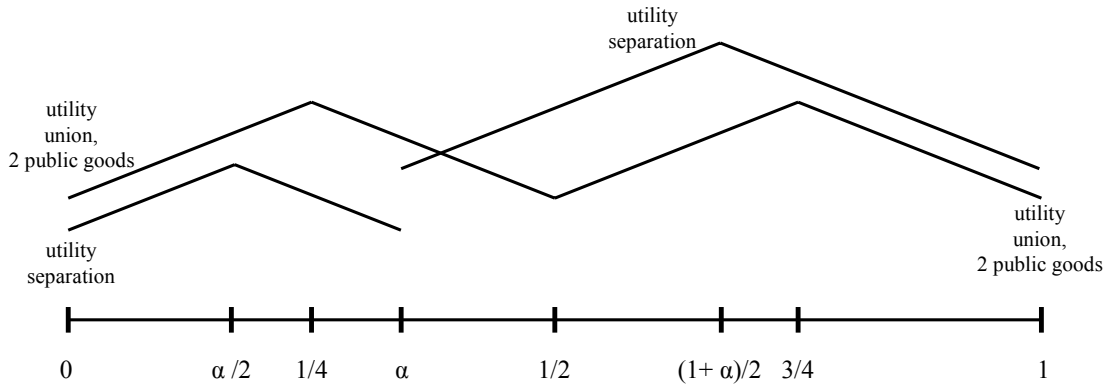

Figure 1a: Case A

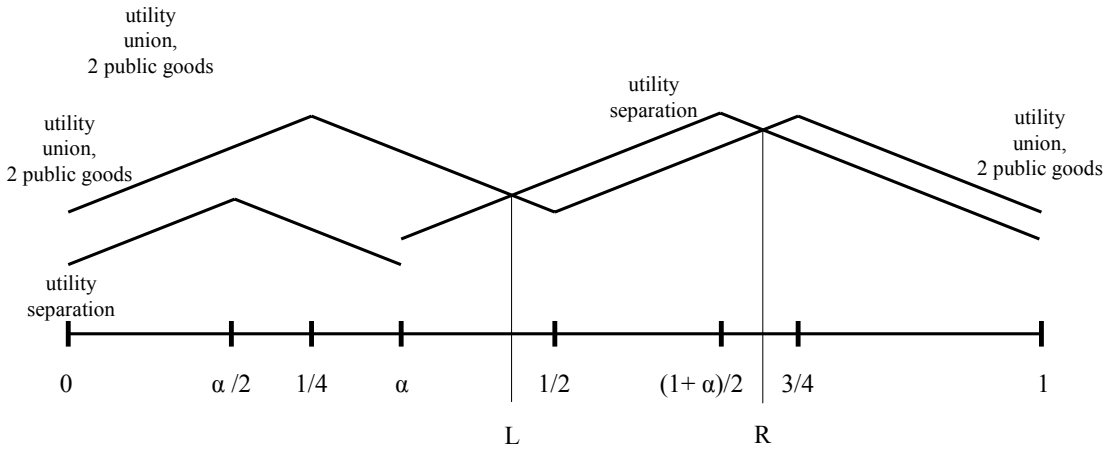

Figure 1b: Case D

Figure 3.1: Preference of voters.

location for the individuals in $(\alpha/2, \alpha)$ and $((1+\alpha)/2, 1)$, while for the individuals in $(0, \alpha/2)$ and $(\alpha, (1+\alpha)/2)$ utility is decreasing with respect to location. 3/4 is always larger than $(1+\alpha)/2$ since $\alpha < 1/2$. Therefore, if individual 3/4 prefers separation, then all individuals between $(1+\alpha)/2$ and 3/4 prefer separation (case $\mathcal{A}$) as well. Moreover, a majority of the individuals in the large region then prefers separation over unification. The individual at 3/4 prefers separation when his utility under unification, $U_{2PG}(3/4)$, is lower than his utility under separation, $U_{II}(3/4)$

$$U_{2PG}(3/4) = g - 2F + y < g(1 - a|\frac{3}{4} - \frac{1+\alpha}{2}|) - \frac{F}{1-\alpha} + y = U_{II}(3/4) \tag{3.7}$$

That is, if $\alpha > 1 - 4F/ga$.
So for $4 < F < ga/4$ and $\alpha > 1 - 4F/ga$ the individual at 3/4 prefers separation over unification with two public goods and hence a majority of the individuals in the large region prefers separation over unification.

Now take case $\mathcal{D}$. I will show that a majority of the voters in the large region prefers unification in this case. Since utility is continuous with respect to location in a union, there should be some individual between $(1+\alpha)/2$ and 3/4 who is indifferent between unification and separation. I call this individual R. In a union, the utility of the individuals in $(1/4, 1/2)$ is decreasing with respect to location, while under separation utility is increasing with respect to location. I therefore claim that there is an individual who is indifferent between unification and separation. I call this individual L. All the individuals located between L and R are in favor of separation.

To find the value of L use the payoff under unification, $U_{2PG}(L)$, and the payoff under separation, $U_{II}(L)$, to determine the value of L for which both payoffs are equal.

$$U_{2PG}(L) = g(1 - a|\frac{1}{4} - L|) - 2F + y = g(1 - a|\frac{L - 1 + \alpha}{2}|) - \frac{F}{1-\alpha} + y = U_{II}(L) \tag{3.8}$$

This equality is satisfied for

$$L = \frac{3}{8} - \frac{F}{ga} + \frac{1}{4}\alpha + \frac{F}{2ga(1-\alpha)} \tag{3.9}$$

Note that for $\alpha < 1/4$ the utility of the individual at 1/4 is higher in a union with two public goods than under separation. This follows from:

$$U_{2PG}(\frac{1}{4}) = g + y - 2F > g(1 - a(\frac{1+\alpha}{2} - \frac{1}{4})) + y - \frac{F}{1-\alpha} = U_I(\frac{1}{4}) \tag{3.10}$$

that is, if $\alpha < 1 - 4F/ga$, which is satisfied since for $\alpha > 1 - 4F/ga$ both individuals would prefer separation. For $\alpha > 1/4$ the utility of the individual at α is higher in under unification than under separation. This is shown as follows:

$$\begin{aligned} U_I(\alpha) = g(1 - a(\alpha - \frac{1}{4} - \alpha)) + y - 2F > \\ g(1 - a(\frac{1+\alpha}{2} - \alpha)) + y - \frac{F}{1+\alpha} = U_{2PG}(\alpha) \end{aligned} \tag{3.11}$$

that is, if $\alpha < 1 - 4F/3ga$, which is satisfied when $\alpha < 1 - 4F/ga$. From this it follows that L is indeed in the large region between α and $1/2$.

To find the value of R use the payoff under unification, $U_{2PG}(R)$, and the payoff under separation, $U_{II}(R)$, to determine the value of R for which both payoffs are equal.

$$U_{2PG}(R) = g(1 - a|\frac{3}{4} - R|) - 2F + y = g(1 - a|R - \frac{1+\alpha}{2}|) - \frac{F}{1-\alpha} + y = U_{II}(R) \quad (3.12)$$

This equality is satisfied for

$$R = \frac{5}{8} + \frac{F}{ga} + \frac{1}{4}\alpha - \frac{F}{2ga(1-\alpha)} \quad (3.13)$$

The individuals in favor of separation, i.e. the individuals between L and R, form a majority if

$$R - L > \frac{1-\alpha}{2} \quad (3.14)$$

This condition can be rewritten as $\alpha > 1 - 4F/ga$, which is never satisfied since for $\alpha > 1 - 4F/ga$ case $\mathcal{A}$ would obtain. Hence we see that when $F < ga/4$ for $\alpha < 1 - 4F/ga$ we will never observe a majority in favor of separation in the large region. □

I summarize the outcomes under majority voting in the following Proposition.

Proposition 3.3.1. *The outcomes under majority voting are given as follows: (a) If $F < ga/8$ then there is unification if and only if $\alpha \in (0, 4F/ga]$, (b) If $ga/8 < F < ga/4$ then there is unification if and only if $\alpha \in [1 - 4F/ga, 4F/ga]$, (c) If $ga/4 < F < ga/2$ then there is unification if and only if $\alpha \in [1 - 2F/ga, 1/2]$, (d) If $ga/2 < F$ then there is unification for all $\alpha \in [0, 1/2)$.*

These results are illustrated in Figure 3.2. This figure also shows what the socially optimal outcome is. The socially optimal outcomes are discussed in more detail in Section 3.4.
For low values of F ($F < ga/4$) and relatively large values of α we observe separation. Individuals in the large region have incentives for separation so that they can exert more influence on the type of public good provided, while individuals in the small region always prefer a union with two public goods. For intermediate values of F ($ga/4 < F < ga/2$) we observe separation when α is relatively small. Individuals in the large region prefer separation in order to provide relatively more public goods (incentives for public good provision) *and* to have a greater influence on its type (incentives for separation), while the individuals in the small region always prefer a union with one public good. Finally, when public good provision is costly ($F > ga/2$) a majority in both regions prefer a union with one public good.

3.4 Social optimum

The social optimum: I start by observing that two public goods located at $1/4$ and $3/4$ induce lower transport costs as compared to two public goods located at $\alpha/2$ and $(1+\alpha)/2$. Hence it is socially better to have a union with two public goods as compared to two separate nations.

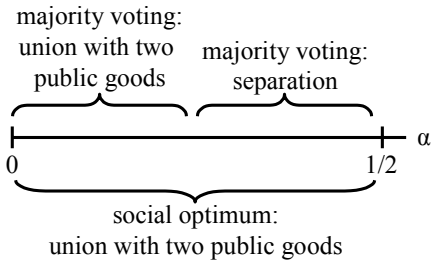

Figure 2a: F<ga/8

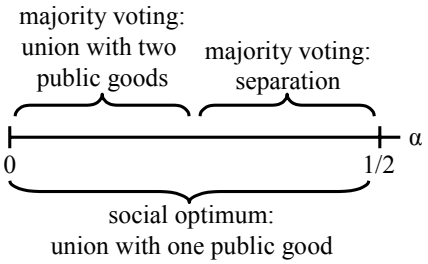

Figure 2b: ga/8<F<ga/4

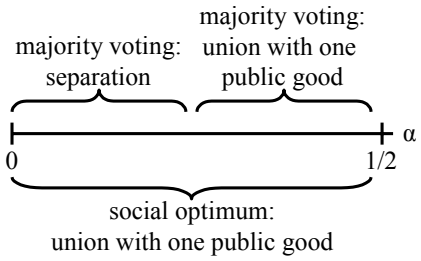

Figure 2c: ga/4<F<ga/2

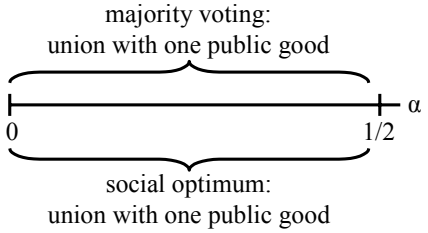

Figure 2d: F>ga/2

Figure 3.2: Majority voting and social optima.

Lemma 3.4.1. *In all cases a union with two public goods is preferred over two separate nations with public goods in each nation.*

Proof: In the social optimum the sum of all individual utilities is maximized. If it is optimal to have a union with two public goods, then it will be socially optimal to choose the location of the public goods and the tax level to maximize the aggregate payoff U_{2PG} to all individuals in a union with two public goods:

$$U_{2PG} = \int_0^1 U_{2PG}(i)di = g(1 - aE(d_i|l)) + y - E(t) \tag{3.15}$$

where $E(d_i|l)$ and $E(t)$ are, respectively, the average distance to the public good closest to individual i given the locations of the two public goods and $E(t)$ the lump sum tax level in the nation. In order to minimize $E(d_i)$ it is socially optimal to locate the two public goods at 1/4 and 3/4. $E(d_i|l)$ will then be 1/8. Since there are two public goods, $E(t)$ will be $2F$.

If it is optimal to have two separate nations with two public goods then it will be socially optimal to choose the locations of the public goods and the tax levels to maximize the aggregate payoff U_{II} to all individuals in the two nations:

$$U_{II} = \int_0^1 U_{II}(i)di = \sum_{x=A,B} s_x[g(1 - aE_x(d_i|l_x)) + y - E_x(t_i)] \tag{3.16}$$

where $E_x(d_i|l_x)$, s_x and $E_x(t_i)$ are, respectively, the average distance in country x given the location of the public good, the size of country x and the lump sum tax level in country x. Since the value of α is exogenously specified, the values of s_A and s_B are α and $1 - \alpha$, respectively. In order to minimize $E_x(d_i)$ it is socially optimal to locate the public good in the middle of each country. Hence, $E_A(d_i)$, $E_B(d_i)$ and $E(d_i)$ are, respectively, $\alpha/4$, $(1 - \alpha)/4$ and 1/4. Each country has to finance its own public good, therefore $E_A(t_i)$, $E_B(t_i)$ and $E(t_i)$ are, respectively, F/α, $F/(1 - \alpha)$ and F.

Hence, both social utility expressions can be rewritten as follows:

$$U_{2PG} = g(1 - \frac{a}{8}) + y - 2F \tag{3.17}$$

$$U_{II} = \alpha[g(1 - a\frac{\alpha}{4})] + (1 - \alpha)[g(1 - a\frac{1 - \alpha}{4})] + y - 2F \tag{3.18}$$

A union with two public goods will always be preferred over two separate nations if $U_{2PG} > U_{II}$ for all possible parameter values. Rearranging the terms in the inequality $U_{2PG} > U_{II}$ gives the following inequality:

$$\frac{1}{2}\alpha^2 - \frac{1}{2}\alpha + \frac{1}{8} > 0 \tag{3.19}$$

Since this inequality always holds, a union with two public goods is always better than two separate nations. □

To determine the social optima we thus have to choose between a union with two public goods and a union with a single public good. If the costs of the public good are high, i.e. if F is big, then it is socially optimal to have one public good. The following proposition summarizes these considerations.

Proposition 3.4.1. *If $F > ga/8$ then a union with one public good will be the social optimum and if $F < ga/8$ then a union with two public goods will be the social optimum.*

Proof: In the social optimum the sum of all individual utilities is maximized. If it is optimal to have a union with two public goods, then it will be socially optimal to choose the location of the public goods and the tax level to maximize the aggregate payoff U_{2PG} to all individuals in a union with two public goods:

$$U_{2PG} = \int_0^1 U_{2PG}(i)di = g(1 - aE(d_i|l)) + y - E(t) \tag{3.20}$$

where $E(d_i|l)$ and $E(t)$ are, respectively, the average distance to the public good closest to individual i given the locations of the two public goods and $E(t)$ the lump sum tax level in the nation. In order to minimize $E(d_i)$ it is socially optimal to locate the two public goods at 1/4 and 3/4. $E(d_i|l)$ will then be 1/8. Since there are two types of public goods, $E(t)$ will be $2F$.

If it is optimal to have a union with two public goods, then it will be socially optimal to choose the location of the public goods and the tax level to maximize the aggregate payoff U_{1PG} to all individuals in a union with two public goods:

$$U_{1PG} = \int_0^1 U_{1PG}(i)di = g(1 - aE(d_i|l)) + y - E(t) \tag{3.21}$$

where $E(d_i|l)$ and $E(t)$ are, respectively, the average distance given the location of the public good and the lump sum tax level in the nation. In order to minimize $E(d_i)$ it is socially optimal to locate the two public goods at 1/2. $E(d_i|l)$ will then be 1/4. Since there is one type of the public good, $E(t)$ will be F.

Hence, both social utility expressions can be rewritten as follows:

$$U_{1PG} = g(1 - \frac{a}{4}) + y - F \tag{3.22}$$

$$U_{2PG} = g(1 - \frac{a}{8}) + y - 2F \tag{3.23}$$

Comparing the total utilities under unification and separation determines the choice for either one or two public goods in a union. It is better to have one public good if and only if $U_{1PG} > U_{2PG}$:

$$U_{1PG} = g(1 - \frac{a}{4}) + y - F > g(1 - \frac{a}{8}) + y - 2F = U_{2PG} \tag{3.24}$$

After rearranging terms, we find that a union with one public good is the social optimum if $F > ga/8$ □

3.5 Comparison

Majority voting and social optimum compared: A comparison of the outcomes under majority voting and the social optima reveals:

Proposition 3.5.1. *(i) If $F < ga/8$ then a union with two public goods is socially optimal for all $\alpha \in [0, 1/2]$ but a union with two public goods obtains for all $\alpha \in [0, 4F/ga]$ and separation obtains under majority voting for all $\alpha \in [4F/ga, 1/2]$, (ii) If $ga/8 < F < ga/4$ then a union with one public good is socially optimal for all $\alpha \in [0, 1/2]$ but a union with two public goods obtains for all $\alpha \in [1-4F/ga, 1/2]$ and separation obtains under majority voting for all $\alpha \in [1-4F/ga, 1/2]$, (iii) If $ga/4 < F < ga/2$ then a union with one public good is socially optimal for all $\alpha \in [0, 1/2]$ but separation obtains under majority voting for all $\alpha \in [0, 1-2F/ga]$, and (iv) If $F > ga/2$ then a union with one public good is socially optimal as well as the majority voting outcome for all $\alpha \in [0, 1/2]$.*

These results are illustrated in Figures 3.2.[9] One of the main findings of the above result is that there exist excessive incentives for the provision of public goods. For different values of F, there are also excessive incentives for separation, which are partly due to the excessive incentives for public good provision. The excessive incentives for public good provision appear most distinctly for $ga/8 < F < ga/4$ and small values of α, while the excessive incentives for separation appear most distinctly for $F < ga/8$ and relatively large values of α. I now elaborate on the sources of this inefficiency.

The excessive provision of public goods arise out of the way the costs and benefits of the public goods are distributed. In a union the costs of an additional public good are F which are borne equally by the individuals in the union because of the lump-sum taxation system. On the other hand, the benefits of the additional public good of an individual depend on the location of the individuals. The individuals located in the center of the union will lose most from the second public good in the union and the two groups of individuals located at both extremes gain the most. The aggregate increase in the payoff of these individuals (located towards the corners), however, is less than the decrease in the payoff of the individuals located in the center of the region. In the case of separation the individuals located close to the boundary between the two regions will lose the most and again the individuals located to the corners will gain the most.

3.6 Concluding remarks

The analysis of this model yields us two principle insights. *Firstly*, in line with the analysis presented in Chapter 2, that the large region is less keen on unification as compared to the small region. This result is due to the fact that the tax advantages from union are increasing and (strictly) convex in the size of the other region, while the political costs are linear. Thus a union with a very small region fails to generate adequate tax advantages for the large region for a certain class of parameters. In the large region the incentives for unification are larger when the population in the large region is not uniformly distributed but concentrated and when the political influence of the small region in a union is smaller. *Secondly*, I find that the outcomes under majority voting typically lead to too many public goods provided as compared to what is socially optimal. This is due to the fact that

[9]Note that $F < ga/8$ implies that $4F/ga < 1 - 4F/ga$, that $F > ga/4$ implies $1 - 2F/ga < 2F/ga$ and that $F > ga/2$ implies that $2F/ga > 1$ and $1 - 2F/ga < 0$ (and thus $1 - 2F/ga < 2F/ga$).

whereas the tax advantages of having one public good are shared evenly by voters in a region, the political costs are unevenly distributed and this generates externalities which lead to inefficient outcomes.

There are several directions in which the model can be extended. First, the analysis presented in this chapter makes a step to vary the amount of public goods provided by allowing for the provision of two types of public goods in a union. A genuine variable amount of the public goods, however, will provide more profound insights into how the incentives for unification, for separation and for public good provision are related. A model with an amount of public goods varying with country size is discussed in Chapter 4. Second, the role of decentralized public good provision -and connected, the spillover effects of public goods provision- deserves a more thorough study. Third, one can examine the robustness of the results with respect to a variety of voting rules.[10] Fourth, I did not take into account the transfers a government can make. These transfers can be inter-individual or inter-regional and obviously have an effect on the incentives for unification. Intergovernmental transfers and local public good provision with positive spillovers are studied in Chapter 5.[11] Another dimension of the robustness question is how decisions on unification and separation are affected by (the threat of) violence. There may be groups of persons who are unhappy with the voting outcome and they may use violent means to have their way. Chapter 6 discusses the interplay of violence and secessionism.

[10]See Chapter 2 for a discussion of a variety of these rules.

[11]Bolton and Roland (1996), Dixit and Londregan (1998), Lockwood (2002) and Lülfesmann (2002) also study the role of transfers.

Chapter 4

Country size and public good provision

4.1 Introduction

Political instability and border redrawings are quite common. A few examples are former republics like the Soviet Union, Yugoslavia and Czechoslovakia or the Basques in Spain and the Kurds in Iraq and surroundings. The number of countries has increased significantly in the last century, from 62 in 1914 to 193 at present.[1] This increase is induced partly by decolonization, but also in for example Europe the number of countries increased, from 32 to 48. Another development is the significant increase in public spending, as a share of GDP as well as in absolute terms: public spending rose from 10,7% around 1870, 27,9% in 1960 to 45,6% in 1996 for a group of 17 industrial countries. These figures include redistribution but also government real expenditure, defined as the sum of government salaries and supplies purchased by the government, increased from 4,6% around 1870, 12,6% in 1960 to 17,3% in 1995.[2] In this Chapter, I study the relationship between the increase of public spending and the increase in the number of countries.

Border changes and the equilibrium number of countries are studied by Alesina and Spolaore (1997) and this chapter extends their seminal work. In their research, country formation is the result of a trade-off between the benefits of larger political entities and the costs of heterogeneity in larger communities. The benefit of living in larger countries is that the fixed costs of public good provision in a country can be spread over more individuals. The increase in public spending mentioned above therefore increases the incentives to form larger countries, which contradicts the increase in countries observed in the same period. Since the benefits of public goods provision are not fixed in the model used in this chapter, as they are in Alesina and Spolaore's research, the increase in public spending does not lead to a conclusion which contradicts the increase in the number of countries mentioned above.

One of the core assumptions of the Alesina and Spolaore (1997) model is thus that the benefits and the costs of public goods are assumed to be fixed, i.e. do not depend

[1] See The Economist, January 3, 1998, pp.63-65.

[2] The data on public spending come from Tanzi and Schuknecht (2000), Table I.1 and Table II.1.

on country size. Alesina and Wacziarg (1998), however, present empirical evidence that total public spending is increasing in country size. Although the results of Alesina and Spolaore generalize when public spending increases linearly with country size, the benefits of public spending remain constant. This leads to the anomaly that the benefits of a good are not increasing in the amount of the good nor in the resources used to provide these goods. Another implication of the fixed benefits and fixed costs assumptions is that if the increase in public spending mentioned above is modelled as an increase in fixed costs, the equilibrium size of countries will increase. This contradicts the increase in the number of countries mentioned at the start of the introduction. In my analysis I therefore assume that total public spending as well as the payoff from public spending is increasing in country size.

The payoff of the public good is increasing in country size since larger countries spend more on public goods. Apart from this, there are other reasons why individuals are better off when living in larger countries. Two reasons are given by Alesina and Spolaore themselves. Firstly, larger countries are less susceptible to uninsurable shocks. Secondly, security considerations are smaller in larger countries. One more reason is given by Le Breton and Weber (2003). In some countries, particularly China, France, Russia, India and Pakistan citizens value their country's political and military might. Since a country's standing and influence in the world is increasing in its size, the payoff from government (public good) is increasing in country size.

Alesina and Wacziarg (1998) present empirical evidence that public spending is increasing less than proportionally in country size. In my model the per capita costs of government is therefore decreasing in country size and the payoff of government is increasing in country size. I use unidimensional spatial modelling of the heterogeneity of citizen's preferences among voters over the provision of public goods. In another part of the analysis I still use spatial modelling and the payoff of government is still increasing in country size, but solely on account of the larger public spending by larger countries. This makes it possible to study two more topics which cannot be studied using fixed costs and fixed benefits assumptions. Firstly, I examine the effect of the previously mentioned massive increase in public spending on the equilibrium size of countries. Secondly, I investigate how institutions for public good provision, i.e. how presidential-congressional regimes and parliamentary regimes, affect country size.

The main results in this chapter are the following. Equilibrium country size depends on the balance between on the one hand the diminishing marginal returns of country size and on the other hand the increasing political costs. Under more general assumptions than in the existing literature, I find that the equilibrium size of countries is smaller than socially optimal under certain rules for secession, while for other rules it is not. An increase in public spending decreases the equilibrium and the socially optimal size of countries. Finally, I argue that the equilibrium size of countries with parliamentary regimes is smaller than the equilibrium size of countries with presidential-congressional regimes. I discuss these results in more detail below.

In models with a fixed costs and fixed benefits assumption for public spending it is a general finding that majority voting leads to excessive incentives for separation from a social point of view. In my model, however, there is an additional advantage of an

increase in country size. The payoff from the public goods provided is increasing in country size, so individuals are better off when the size of their country increases. These benefits for the individuals within a country turn out to be smaller than the costs of losing political influence when country size increases. This implies that there are still excessive incentives for separation. When the possibility of secession is however limited, like it often is in practice, equilibrium country size need not be smaller than the socially optimal country size.

Intuitively, an increase in public spending can have two opposite effects. On the one hand, more public spending and thus a higher payoff from public spending makes it more important for individuals to locate the public good nearby, inducing a smaller equilibrium size of countries. On the other hand, an increase in public spending makes it more important to share the costs over a larger number of individuals, thus inducing a greater equilibrium size of countries. Beforehand, it is not obvious which effect will prevail. I show that an increase in public spending has a negative effect on equilibrium country size. This effect is created by on the one hand the diminishing marginal benefits of public spending and on the other hand the increase in the importance of political influence. More public spending implies that the marginal benefits of public spending are lower, which means that the decrease in total public spending when country size decreases becomes less important. Moreover, more public spending also implies that political influence becomes more important, and individuals have more influence in smaller countries.[3]

In a presidential-congressional democracy, there is a clearer separation of legislative and executive power than in a parliamentary democracy. Based on a spatial model I show that the greater separation of the legislative and the executive power in a presidential-congressional democracy implies that public spending is smaller under presidential-congressional regimes. Persson, Roland and Tabellini (2000) give empirical evidence that public spending is smaller under presidential-congressional regimes than under parliamentary regimes. Since I also find that an increase in public spending has a negative influence on country size, this implies that the equilibrium size of countries with parliamentary regimes is smaller than the equilibrium size of countries with presidential-congressional systems.

Before proceeding with the research, I first mention some related literature. For a more extensive discussion of some of the literature see Bolton, Roland and Spolaore (1996).

Hotelling's (1929) location model representing the heterogeneity of voters over the provision of public goods is also used (implicitly or explicitly) by Alesina and Spolaore (1997), Le Breton and Weber (2003), Goyal and Staal (2004), Casella (1992), Casella and Feinstein (2002), Etro (2003), Feinstein (1992) and Wei (1991a,b). The authors of the first three papers assume that the public good has fixed costs and fixed benefits while in this chapter the spending on and the payoff of the public good is increasing in country size. In the latter six papers the focus is on political integration and trade. In their papers,

[3]One may argue that the relative importance of public spending has increased due to a decrease in the average size of a country. There are, however, external factors explaining the increase in public spending, for example by the increase in economic openness. Rodrik (1998) argues that openness induces a larger susceptibility to external shocks and that open countries therefore need a larger public sector to provide a stabilizing role. Rodrik (1998) and Alesina and Wacziarg (1998) also present empirical evidence that openness and government spending are positively related.

Casella and Feinstein specify a functional form for the relationship between taxes and the public good which satisfies the assumptions made in this chapter. In these three papers, however, the focus is on market partition and trade, while my focus is more on secession in a political jurisdiction and public spending.

Heterogeneity in income is the primary focus in the papers by Buchanan and Faith (1987), Fidrmuc (1999) and Bolton and Roland (1997). This literature shows that fiscal accommodation does not prevent the break-up of countries under all circumstances and that fiscal accommodation may lead to higher taxes. The focus of this part of the literature is, however, primarily on redistribution confllicts, not on preference heterogeneity over public good provision.

The choice between centralization and decentralization of policy with spillovers across countries or regions is studied by Besley and Coate (1999), Ellingsen (1998) and Lockwood (2002). In contrast with the findings when using spatial modelling, they find that there can be either too little or too much integration in equilibrium. In these papers, centralized policy is nonuniform, while in this chapter centralized policy making leads to uniform outcomes.

In the remaining of the chapter I start with discussing the model and its assumptions in Section 4.2. Section 4.3 studies the socially optimal outcome and the equilibrium outcome and discusses the rules which are used in the model for creating countries. In Section 4.4 I explore the role of public good provision, the effects of an increase in public spending and the influence of forms of governments on country size. Section 4.5 concludes and most proofs are in the Appendix.

4.2 The model

Like Alesina and Spolaore (1997) I focus on the trade-off between the benefits of large countries and the accompanying costs of heterogeneity in large populations. They argue that larger political jurisdictions bring about several benefits. Firstly, the per capita costs of several public goods is decreasing with the population size. Secondly, increasing returns in the size of the economy implies increasing returns in the size of countries. Thirdly, exposure to uninsurable shocks is more costly for smaller countries. Lastly, security considerations can be taken more effectively by larger countries. Le Breton and Weber (2003) argue that in addition larger countries have a larger standing in the world, making citizens better off. The counterbalancing effect of increasing the size of political jurisdictions is that individuals are less likely to get the type of public goods they prefer.

In order to keep the model tractable, I consider only one public good (also called type of government or public service), which identifies each country. The public good identifies a bundle of administrative, judicial and economic services and other public policies. I consider only a single dimension along which the different possible types of public goods are distributed. This dimension stretches form minus infinity to plus infinity. The type of public goods provided by a country is presented by a location on this line. I assume that there is a world population with ideal points distributed evenly on the same dimension.

Individuals' utility is decreasing with the distance of their government from their ideal point. Distance can be interpreted in a geographical and in a preference dimension. In

the former interpretation, utility is decreasing since individuals further away from the government have higher transportation costs and in the latter, utility is decreasing since the type of public goods provided differs more from the most preferred type.

Every country needs a single government and the citizens of each country have to finance and can take advantage of the only government of their country. The public goods provided in different countries differ in their types, that is in their location, but they can also differ in the amounts provided. Throughout the model, I assume that country size is determined first, and then individuals within countries vote on the type of public goods.

Alesina and Wacziarg (1998) find that there is a positive relationship between country size and total public spending in a country, and that total public spending is rising less than proportionally in country size. Their analysis implies that the per capita cost of public good provision is large for small countries and lower for larger countries. Assuming balanced government budgets, I use these findings as stylized facts fixing the relationship between country size and the tax levels individuals have to pay. The lump-sum tax level an individual in a country of size s has to pay is denoted by $t(s)$ and satisfies the following assumptions:

$$(A1) \quad \begin{cases} t(s) > 0 & \forall s \\ t'(s) < 0 & \forall s \\ t''(s) > 0 & \forall s \\ lim_{s\to\infty} t'(s) = 0 \end{cases}$$

These conditions state that the tax level is always positive and a convex function of country size and that the marginal decrease in the tax level is arbitrary small for sufficiently large countries Another implication of the findings by Alesina and Wacziarg (1998) is that total public spending $st(s)$ is increasing in country size. For the results presented in Section 4.3 it is, however, not necessary to assume that $st(s)$ is increasing in s.

The maximum utility of the public good in country of size s is denoted by $g(s)$, where the utility can be derived from benefits from country size and from the benefits of the public goods provided by a country. It satisfies the following assumptions:

$$(A2) \quad \begin{cases} g'(s) \geq 0 & \forall s \\ g''(s) \leq 0 & \forall s \\ Inada: & lim_{s\to 0} g'(s) = \infty \\ & lim_{s\to\infty} g'(s) = 0 \end{cases}$$

The assumptions imply that the maximum payoff of the government is increasing in country size, since for example larger countries spend more on public goods and since larger countries are less susceptible to uninsurable shocks. The marginal increase in the payoff of the public, however, diminishes for larger country sizes. In addition, I assume that $g(s)$ satisfies Inada-type conditions. These conditions state that the marginal gain in utility of increasing the size of the jurisdiction is arbitrary large when the jurisdiction is sufficiently small and that the marginal gain is very small when the jurisdiction is sufficiently large. The Inada conditions are necessary to insure that there exist equilibrium country sizes and socially optimal country sizes.

The aggregate payoff of the public good in a country is $sg(s)$ which satisfies the following assumptions:

$$(A3) \quad \begin{cases} \left(\frac{d}{ds}\right)^2 sg(s) > 0 & \forall s \\ lim_{s\to\infty} \frac{d}{ds} sg(s) = g(s) \end{cases}$$

The aggregate payoff of the public good in a country is increasing faster in the size of the country for larger countries since public good provision is larger and for arbitrarily large countries the marginal increase is equal to $g(s)$ since the effect on the marginal payoff of government becomes negligible.

The loss in utility when an individual suffers when the type of government is far from his preferred type is scaled by the positive parameter a. The preference distance from individual i to his government is denoted by d_i. This implies that the utility an individual i derives from the public good provided is equal to $g(s)(1 - ad_i)$. Every individual has the same exogenous income y and has to pay a tax $t(s)$. The utility of individual i living in a country of size s thus is

$$U_i = g(s) - ag(s)d_i + y - t(s) \tag{4.1}$$

In these type of models, individuals who are close to each other in terms of preferences clearly prefer to form a country together. When there is no relationship between geographical location and preferences, also countries which are not connected could emerge. Assuming that geographical and preference dimension coincide prevents the creation of disconnected countries. Therefore I do not analyze geographic mobility, which would break the link between geographical locations and preferences.[4]

I now discuss two examples of public goods or types of government along with the model. For the first example, consider monetary policy. An individual benefits from living in a larger jurisdiction with a single currency since its money is used more widely. The distance costs, however, are that the monetary policy in a large jurisdiction probably differs from the one preferred by this individual while the costs of monetary policy are decreasing in the size of the jurisdiction, reflecting economies of scale. For the second example, consider a machinery of government. Larger jurisdictions have larger machineries offering more services, which is advantageous, but an individual also has to travel more to the point where the government is located. As long as the number of civil servants is increasing less than proportionally in country size, the per capita costs are falling in country size. In the first example, the model is interpreted in a preference dimension, while in the last example the interpretation is geographical.

In order to study the equilibrium size of countries, I define three rules governing secession and determining the equilibrium size of countries: the principles of (i) internal stability and (ii) border stability and (iii) how a border change of a country is affecting other countries.

[4]Like Alesina and Spolaore (1997) one can fix the payoff and the costs of public good provision. Apart from the Inada conditions in $(A1)$ this a special case of the model presented above. Doing so in this model obtains similar conclusions as Alesina and Spolaore. The model of Alesina and Spolaore is thus a special case of this framework. A rigorous proof of this is available upon request.

What I call the principle of border stability implies that an individual on the border of a country wants to abandon a country and join a neighboring one, individuals of the former country cannot prevent it. This is the equivalent of the rule "Each individual at the border between two countries can choose which country to join" used by Alesina and Spolaore (1997). The principle of internal stability implies that individuals within an existing country make decision on country size in referenda with pairwise comparisons of country sizes. In a country, referenda can be held on increasing or on decreasing its size. The third principle is that when a country size is changed, all countries at the side of the border change move to make up for the change.

The first and the last principle together are close to the principle that "borders can be changed if a majority of the citizens of the countries are affected by the border change are in favor of it" used by Alesina and Spolaore. Internal stability requires that a majority of the individuals of the country which borders are changing agree. When referenda would be organized in all countries affected by the accompanying changes in borders aimed at in the third principle, it would turn out that there is no strict majority against these changes.

Finally, in the general model country size is determined first and then the individuals vote on the type of public goods provided in each country.

4.3 Analysis of the general model

In this section the socially optimal outcome is studied first. Then the internal and border stable country sizes are used to determine the equilibrium country size and the section concludes with a comparison of the socially optimal and the equilibrium country size.

In the social optimum the locations and sizes of countries are chosen to maximize the aggregate payoff. This is equivalent to maximizing the average payoff of an individual. More details on the derivation of the socially optimal country size are in the Appendix.

Proposition 4.3.1. *The socially optimal size s of a country is implicitly given by* $\frac{1}{4}a\frac{d}{ds}sg(s) = g'(s) - t'(s)$.

It follows that a benevolent planner balances the marginal effect of distance costs (on the left hand side of the equality) with an individual's gain of an increase in country size (on the right hand side of the equality). The marginal gain of an increase in country size is the net effect due to the increase in public good provision, $g'(s)$, corrected for the decrease in the tax level, $t'(s)$. An increase in the distance costs parameter a decreases the socially optimal size of a nation.

In order to study the equilibrium size of countries, I have defined rules affecting country size. The first principle is that of internal stability. Details on the derivation of the internal stable country size are in the Appendix. The internal stable size s of a country is implicitly given by $\frac{1}{2}ag(s) = g'(s) - t'(s)$. It follows that individuals compare the increase in distance costs with an individual's gain of an increase in country size. An increase in the distance costs parameter a thus decreases the internal stable size of a nation. When distance costs become more important, individuals will get stronger preferences for living in a small country and thus refusing the enlargement of their country.

The second principle is that of border stability. Details of the computation of the following are in the Appendix. The border stable size s of a country is implicitly given by $\frac{1}{2}a\frac{d}{ds}sg(s) = g'(s) - t'(s)$. Individuals thus compare the marginal effect of distance costs with an individual's gain of an increase in country size. An increase in the distance costs parameter a decreases the border stable size of a nation. When distance costs become more important, individuals will get stronger preferences for living in a small country and thus leaving a big one for a small one.

Since $\frac{d}{ds}sg(s) > sg(s)$ it follows that the border stable country size is always smaller than the internal stable size[5]. In the following Proposition I give the equilibrium size of countries under majority voting. Countries of this size are internal as well as border stable. The result immediately follows from the results stated above.

Proposition 4.3.2. *The equilibrium size s of countries under majority voting is given by the value satisfying* $\frac{1}{2}a\frac{d}{ds}sg(s) = g'(s) - t'(s)$.

Since the internal stable size is larger than the border stable size, individuals in a certain country may want to secede, while the other individuals in the country prefer the actual country size. This can be interpreted as a cause of the origination of -possibly violent- secessionist movements.

Now compare the social optimum with the outcome under majority voting. For both cases country sizes are implicitly given above.

Corollary 4.3.1. *Since* $\frac{1}{4}a\frac{d}{ds}sg(s) < \frac{1}{2}a\frac{d}{ds}sg(s)$, *majority voting leads to excessive incentives for separation.*

From the inequalities implicitly specifying the internal and border stable country sizes the terms on the right hand side, $g'(s) - t'(s)$, show that the potential marginal benefits from a change in country size are equal for all individuals. The individuals, however, do not internalize the losses or gains secession brings forth for other individuals. Individuals on the boundary look at the marginal increase in their payoff ($\frac{1}{2}a\frac{d}{ds}sg(s)$) when they join the neighboring country. These benefits from secession are, however, smaller than $\frac{1}{2}a\frac{d}{ds}sg(s)$, the aggregate benefits from a social welfare point of view.

4.3.1 Rules for changing country size

Bordignon and Brusco (2001) ask whether the constitution of a federation should allow for peaceful secession. In case the federation breaks down they argue that constitutionally defined secession rules are optimal ex post. On the other hand the success of a federation also depends on the perception of its future duration. Not having constitutional secession rules makes secession more difficult and thus provides an economic advantage. As Bordignon and Brusco noticed, in most countries individuals do not have the right to secede or the right to secede is severely constrained. It is thus relevant to examine the rules for changing country size in more detail. In this section, I consecutively look at what I call

[5]When fixed costs/fixed benefits assumptions for the public good are used, the internal and border stable country sizes are equal.

(i) an autocratic world; (ii) a harmonious world and (iii) an individualistic world. In an autocratic world individuals located on the border do not have the right to secede, in a harmonious world secession can only take place under unanimity and in an individualistic world only individuals located on the border take personal decisions on secessions.

Since the excessive incentives of separation result from individuals on the border not taking into account the externalities secession has on the other individuals, the excessive incentives for separation may be mitigated by limiting the possibility of individuals to secede. In an autocratic world individuals located at the border indeed do not have the freedom granted to them by the border stability rule. Examples of autocracy are Russia in Chechnya and China in Tibet. Another reason to limit the freedom of individuals on the border is when a majority of the citizens in a country value their country's political and military might. Since a country's standing in the world also depends its size, a majority of the country's citizens may specify a constitution which rules out secession. This can be modelled by skipping the border stability rule, but keeping the internal stability rule in combination with the assumption that when a bordering country is affected by a change, all countries at the side of the affected country moved to make up for the change. The equilibrium size s of countries in an autocratic world is given by $\frac{1}{2}ag(s) = g'(s) - t'(s)$. Since $\frac{1}{2}ag(s)$ can be smaller and larger than $\frac{1}{2}a\frac{d}{ds}sg(s)$, we see that we cannot say a priori that in an autocratic world the equilibrium size of countries is smaller than the socially optimal size. This result puts the finding by Alesina and Spolaore (1997) that democratization leads to smaller country size in a broader perspective. Instead of diminishing the possibilities of exploiting more individuals in larger countries, democratization would now imply that individuals get more rights, among other rights the right to secede. This result also implies that due to the absence of constitutional secession rules, countries in the real world are not necessary smaller than socially optimal.

The internal stability rule requires just a majority for a border change. In a harmonious world it can be the case that unanimity within a group is required for a secession of the group or an annexation by the group. An example is the European Union, where there are no constitutional rules specifying how a nation can leave the union. When a country plans to leave the Union, approval by all the others would be necessary.[6] In a harmonious world the rule for changing country size would thus require that individuals within a country take decisions with unanimity on country size in referenda with pairwise comparisons of country sizes. I use this rule together with the assumption that when a bordering country is affected by a change, all countries at the side of the affected country moved to make up for the change. When the voter at $s/2$ prefers an increase in country size all the individuals have the same preference. The voter at $s/2$, however, is always against a decrease in country size since this decrease implies that less public goods are provided and that the individuals incurs higher transportation costs. The *minimum* size of a country in a harmonious world therefore is the internal stable size in the general model. Bordignon and Brusco (2001) already argue that the absence of the possibility to secede in a peaceful and constitutional way, like in for example the European Union, can

[6]The proposals for a constitution of the Union made by Giscard d'Estaing do contain rules specifying how a country can leave the Union.

have serious consequences. When a nation would decide to leave the European Monetary Union or the European Union, it will result in a severe disruption of economic and political relations in Europe. This makes clear that there is disadvantage of the set of secession rules used in a harmonious world. My result also implies that the European Monetary Union or the European Union may therefore be larger than socially optimal.

In an individualistic world or in certain anarchistic situations, individuals do not collectively take decisions on increasing or decreasing country size. Since the internal stability rule requires coordinated decision making with a group of individuals, in an individualistic world the internal stability rule does therefore not hold. The border stability rule, however, is applicable on an individual basis. Thus in an individualistic world only individuals located on the border take personal decisions on secessions, this in contradiction to an autocratic world. The equilibrium size of countries in an individualistic world is thus equal to the equilibrium size in the general model.

4.4 Taxation

Now suppose that the maximum utility of the public good in country i only depends on the total tax revenue in the country. We can denote this maximum payoff by $g(s_i t(s_i))$. The utility of an individual i then becomes the following.

$$U_i = g(s_i t(s_i)) - ag(s_i t(s_i))d_i + y - t(s_i) \tag{4.2}$$

An additional assumption I need in this section is that $st(s)$ is increasing in s. This implies that total public spending is increasing in country size, which is consistent with the empirical findings of Alesina and Wacziarg (1998).

To determine the social optimum we have to choose the location and size of a country to maximize the aggregate payoff. This is equivalent to maximizing the average payoff of an individual. The outcome of the maximization is that the socially optimal size s of a country is implicitly given by $\frac{1}{4}a\frac{d}{ds}sg(st(s)) = \frac{d}{ds}g(st(s)) - \frac{d}{ds}t(s)$ and the internal stable size of a country is implicitly given by $\frac{1}{2}ag(st(s)) = \frac{d}{ds}g(st(s)) - \frac{d}{ds}t(s)$. The border stable size s of a country is implicitly given by $\frac{1}{2}a\frac{d}{ds}sg(st(s)) = \frac{d}{ds}g(st(s)) - \frac{d}{ds}t(s)$. These results can be derived with straightforward adjustments in the derivations of the corresponding results in Section 4.3. In the following Proposition I give the equilibrium size of countries under majority voting and the socially optimal country size. Countries of this size are internal as well as border stable. The Proposition immediately follows from the results stated above.

Proposition 4.4.1. *The equilibrium size s of countries under majority voting is given by the minimum value satisfying $\frac{1}{2}ag(st(s)) = \frac{d}{ds}g(st(s)) - \frac{d}{ds}t(s)$ and $\frac{1}{2}a\frac{d}{ds}sg(st(s)) = \frac{d}{ds}g(st(s)) - \frac{d}{ds}t(s)$. The socially optimal size s of a country is implicitly given by $\frac{1}{4}a\frac{d}{ds}sg(st(s)) = \frac{d}{ds}g(st(s)) - \frac{d}{ds}t(s)$.*

Since $\frac{1}{4}a\frac{d}{ds}sg(st(s)) < \frac{1}{2}a\frac{d}{ds}sg(st(s))$, we see that just as in the general case, majority voting leads to excessive incentives for separation. The above results are parallel to the results in Section 4.3, see this Section for more discussion.

4.4.1 Increase in public spending

In the last 50 years the absolute level as well as the relative share of public spending has increased remarkably. In this subsection I will investigate the influence of this increase on country size. The main result is that an exogenous increase in public spending decreases the equilibrium as well as the socially optimal country size.

Now assume that lump sum tax level an individual in country i has to pay is $\hat{\beta}+t(s_i)$, where $\hat{\beta} > 0$ denotes the increase in public spending. It is easy to verify that this new tax level does not affect the assumptions on $g(.)$ and $t(.)$ specified in Sections 4.2 and 4.4.

¿From Proposition 4.3.1 we know that the socially optimal country size s of a country is implicitly given by

$$\frac{1}{4}a\frac{\partial}{\partial s}sg\left(s\left(\hat{\beta}+t(s)\right)\right)=\frac{\partial}{\partial s}g\left(s\left(\hat{\beta}+t(s)\right)\right)-\frac{\partial}{\partial s}\left(\hat{\beta}+t(s)\right) \tag{4.3}$$

Since $\frac{\partial}{\partial s}sg(s)$ is positive and increasing in s, it follows that an increase in $\hat{\beta}$ will increase $\frac{1}{4}a\frac{\partial}{\partial s}sg\left(s\left(\hat{\beta}+t(s)\right)\right)$. Moreover, an increase of $\hat{\beta}$ will decrease $\frac{\partial}{\partial s}g\left(s\left(\hat{\beta}+t(s)\right)\right)-\frac{\partial}{\partial s}\left(\hat{\beta}+t(s)\right)$. Since an increase in s has similar effects, it follows that an increase $\hat{\beta}$ will decrease the socially optimal country size s.

¿From Proposition 4.4.1 it follows that the equilibrium size of s of countries under majority voting is given by the minimum value satisfying

$$\begin{gathered}\frac{1}{2}ag\left(s\left(\hat{\beta}+t(s)\right)\right)=\frac{\partial}{\partial s}g\left(s\left(\hat{\beta}+t(s)\right)\right)-\frac{\partial}{\partial s}\left(\hat{\beta}+t(s)\right)\\ \textit{and}\\ \frac{1}{2}a\frac{\partial}{\partial s}sg\left(s\left(\hat{\beta}+t(s)\right)\right)=\frac{\partial}{\partial s}g\left(s\left(\hat{\beta}+t(s)\right)\right)-\frac{\partial}{\partial s}\left(\hat{\beta}+t(s)\right)\end{gathered} \tag{4.4}$$

An increase in $\hat{\beta}$ will decrease the equilibrium country size s since changes in $\hat{\beta}$ and in s have similar effects on $\frac{1}{2}ag\left(s\left(\hat{\beta}+t(s)\right)\right)$, $\frac{1}{2}a\frac{\partial}{\partial s}sg\left(s\left(\hat{\beta}+t(s)\right)\right)$ and $\frac{\partial}{\partial s}g\left(s\left(\hat{\beta}+t(s)\right)\right)-\frac{\partial}{\partial s}\left(\hat{\beta}+t(s)\right)$.

¿From the above it follows that both the socially optimal and the equilibrium country size decreases due to an increase in public spending. I formalize this in the following Proposition.

Proposition 4.4.2. *An increase in the level of public spending decreases the equilibrium as well as the socially optimal country size.*

This results from two effects. In the first place, an increase in public spending leads to an increase in the importance of the distance costs. This is represented by $\frac{1}{2}ag\left(s\left(\hat{\beta}+t(s)\right)\right)$, by $\frac{1}{4}a\frac{\partial}{\partial s}sg\left(s\left(\hat{\beta}+t(s)\right)\right)$ and by $\frac{1}{2}a\frac{\partial}{\partial s}sg\left(s\left(\hat{\beta}+t(s)\right)\right)$. More public spending thus induces greater incentives to decrease the distance to the public good. In the second place, an increase in public spending decreases the marginal increase in payoff of increasing country size. This is represented by $\frac{\partial}{\partial s}g\left(s\left(\hat{\beta}+t(s)\right)\right)-\frac{\partial}{\partial s}\left(\hat{\beta}+t(s)\right)$. Higher public spending levels decreases the marginal increase of the maximum payoff of the public good $\frac{\partial}{\partial s}g\left(s\left(\hat{\beta}+t(s)\right)\right)$, not altering the marginal change in the tax level $\frac{\partial}{\partial s}\left(\hat{\beta}+t(s)\right)$.

4.4.2 Parliamentary and presidential-congressional democracies

In this section I study how a political regime influences the public good provision and how this affects the equilibrium size of nations. The first political regime is the parliamentary democracy, where there is a single vote for both the executive and legislative power. In a presidential-congressional democracy, the second regime, there are two separate votes, one for the executive and one for the legislative power. The decision making in a parliamentary democracy is modelled as the election of a so-called citizen candidate. In referenda the individuals in a country can choose between two candidates and the candidate who will finally prevail will determine both the amount and the type of the public good provided by the country. The decision making in a presidential-congressional democracy is modelled with two referenda. In the first referendum the type of the public good is determined while in the second referendum the individuals decide on the level of public goods provision.

In the model of a parliamentary democracy individuals in each country thus elect a representative who will determine the amount of public spending as well as the location of the government. The elected candidate locates the government at his ideal point and chooses the level of public spending (and thus the tax level) to maximize his own payoff. Hence, each candidate will set the same level of public spending if elected. Candidates thus differ only in where they will locate the government. Clearly, the individual in the middle of the country is the only candidate which can not be beaten in an election with two candidates. The elected candidate thus maximizes the following with respect to the tax level $t(s)$.

$$g\left(st(s)\right) + y - t(s) \tag{4.5}$$

The elected candidate therefore equalizes his marginal benefit of public spending with his marginal costs of public spending, that is $g'\left(st(s)\right) = 1/s$.

The median voter theorem implies that in the model of presidential-congressional democracy individuals decide in the referendum on the type of public goods to locate the public goods in the middle of their country. It then follows that the median voters for the level of public good provision are located at 1/4 and 3/4 of a country. Half the individuals (the individuals between 1/4 and 3/4) have smaller distance costs and therefore want to provide more public goods, while half the individuals have larger distance costs and therefore want to provide less public goods. For a given country size s the two median voters choose a tax level $t(s)$ to maximize the following.

$$g\left(st(s)\right) - \frac{1}{4}asg\left(st(s)\right) + y - t(s) \tag{4.6}$$

The two median voters therefore equalize their marginal benefit of public spending with their marginal costs of public spending, that is $g'\left(st(s)\right)/(1 - \frac{1}{4}as) = 1/s$.

For a comparison of public good provision under both regimes first note that in both cases the public good will be located in the middle of the country. To compare the levels of public good provision, it is convenient to rewrite the condition in the parliamentary democracy as $g'\left(st(s)\right) = 1/(s - \frac{1}{4}as^2)$. Since $(1 - \frac{1}{4}as)/s < 1/s$ and since $g'(.)$ is a decreasing function in its argument, the following proposition holds.

Proposition 4.4.3. *In a parliamentary democracy more public goods will be provided then in a presidential-congressional democracy.*

Under a presidential-congressional system less public goods are provided since there is a greater separation of the legislative and executive powers. There are separate elections for both, making it possible that the preference of the decisive voter on the type of the public good diverges from the preference of the decisive voter on the amount. In a parliamentary democracy, however, there is a single election for both powers. Therefore there does not exist a conflict of interest between the executive and legislative power, leading to a higher level of public good provision.

Combining the result of Proposition 4.4.3 with the finding presented in Section 4.4.1 leads to the main result of this section.

Corollary 4.4.1. *The equilibrium size of countries with parliamentary regimes is smaller than the equilibrium size of countries with presidential-congressional regimes.*

4.5 Concluding remarks

This chapter has studied the equilibrium country size: in small countries individuals have a greater influence over the nature of political decision making while in larger countries individuals benefit from lower tax levels and higher public good levels. The extension of the Alesina and Spolaore (1997) framework, making amounts and payoffs of public spending depending on country size, allows to study the relation between public good provision and country size. In the general model, under majority voting the equilibrium size of countries is too small from a social point of view. This need not be the case, however, if one uses other rules for secession. I also argued that an exogenous increase in public spending decreases the equilibrium size of countries, and that the equilibrium size of countries with a presidential-congressional democracy is larger than of countries with a parliamentary democracy.

Two possible directions for further research are the introduction of congestion effects and nonlinear transportation costs in the model. In addition to the increase in heterogeneity of the population, other counterbalancing effects of increasing the size of jurisdictions mentioned by Alesina and Spolaore are congestion and coordination problems. These effects can be studied in the model by specifying a payoff function $g(s)$ which is initially increasing but then decreasing in country size. The examination of nonlinear transportation costs in the model can be done by using any arbitrary function $d(i)$ (instead of d_i) which is increasing in distance of the individual to its government, instead of using a linear function. Broader directions for further research are the introduction of decentralized public good provision, competition of countries with for example defense spending or the distributive role of governments.

My research also offers hypotheses for further empirical work. A first conjecture is that the increase in public spending has had a negative impact on country size. The level of public spending indeed has increased on a large scale and simultaneously the number of countries increased -and thus the size decreased- in the last decennia. However, one has to adjust for external factors like decolonization. A second conjecture is that countries with a presidential-congressional system are on the average larger than countries with a parliamentary system.

4.6 Appendix

Country size and the social optimum

Since the costs of preference distance are linear, maximizing the average payoff of an individual is equivalent with maximizing the payoff of the individuals located at 1/4 and 3/4 of a country. The payoff of an individual located at $s/4$ or $3s/4$ in a country of size s is

$$g(s) - \frac{1}{4}asg(s) + y - t(s) \tag{4.7}$$

Rewriting the first-order condition for maximization with respect to s gives

$$\frac{1}{4}a\left(g(s) + sg'(s)\right) = g'(s) - t'(s) \tag{4.8}$$

Note that $g(s) + sg'(s) = \frac{d}{ds}sg(s)$. Since the marginal increase in the aggregate payoff of all citizens of a country is increasing in country size, $\frac{1}{4}a\frac{d}{ds}sg(s)$ is increasing in s and since the marginal gains of increasing country size are diminishing, $g'(s) - t'(s)$ is decreasing in s. For s arbitrary large, it is equal to zero. This ensures that the socially optimal country size is unique. □

Country size and internal stability

An immediate application of the median voter theorem implies that the government is located in the middle of each country, given country borders.

Without loss of generality assume now that in the first place the individual considering to join the country is located adjacent to and at the right hand side of the country and that in the second place the country under consideration is located between $(0, s)$.

First I will consider the preference of an individual in the middle of the country, that is, the individual located at $s/2$. The individual located at $s/2$ will prefer a country of size s' over a country of size s when his payoff in the former case is larger. That is, when

$$g(s') - ad(s/2, s')g(s') + y - t(s') > g(s) - ad(s/2, s)g(s) + y - t(s) \tag{4.9}$$

Since the public goods will be located in the middle of each country and for $s' > s$, $d(s/2, s') = 1/2(s' - s)$ and $d(s/2, s) = 0$. We can thus rewrite inequality (4.9) as follows.

$$\frac{1}{2}ag(s') < \frac{g(s') - g(s)}{s' - s} - \frac{t(s') - t(s)}{s' - s} \tag{4.10}$$

Taking the limit of s' approaching s gives:

$$\frac{1}{2}ag(s) < g'(s) - t'(s) \tag{4.11}$$

For $s' < s$ the inequality signs of (4.10) and (4.11) will reverse.

Since the marginal gains of increasing country size are diminishing, we have that $g'(s) - t'(s)$ is decreasing in s and obviously, $\frac{1}{2}ag(s)$ is increasing in s. Therefore, $\frac{1}{2}ag(s) = g'(s) - t'(s)$ has a unique solution.

Finally, it is straightforward to show that all the individuals between 0 and $s/2$ will prefer s over s' when $s' > s$ and that the individuals between $s/2$ and s will prefer s over s' when $s' < s$. □

Country size and border stability

A person at the boundary of a country might join another country, but the individual will not do this if his payoff decreases when he moves to the neighboring country. That is, an individual will not move from a country of size s to a country of size s' when the following inequality holds.

$$g(s) - \frac{1}{2}asg(s) - t(s) > g(s') - \frac{1}{2}as'g(s') - t(s') \tag{4.12}$$

This can be rewritten as follows:

$$\frac{1}{2}as'g(s') - \frac{1}{2}asg(s) > g(s') - g(s) - (t(s') - t(s)) \tag{4.13}$$

When $s' > s$ this is equivalent with the following.

$$\frac{\frac{1}{2}as'g(s') - \frac{1}{2}asg(s)}{s' - s} > \frac{g(s') - g(s)}{s' - s} - \frac{t(s') - t(s)}{s' - s} \tag{4.14}$$

Taking the limit of s' approaching s gives:

$$\frac{1}{2}a\frac{d}{ds}sg(s) > g'(s) - t'(s) \tag{4.15}$$

For $s' < s$ the inequality signs of (4.14) and (4.15) will reverse.

Since the marginal gains of increasing country size are diminishing, we have that $g'(s) - t'(s)$ is decreasing in s and by assumption $\frac{1}{2}a\frac{d}{ds}sg(s)$ is increasing in s. Therefore, $\frac{1}{2}a\frac{d}{ds}sg(s) = g'(s) - t'(s)$ has a unique solution. □

Part II

Intergovernmental transfers

Chapter 5

Interference in public good provision

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5.1 Introduction

Inhabitants of villages that are located close by a city usually benefit considerably from the services provided by the city. Many villagers work in the city. Moreover, they often find the city a good place to spend their leisure time. In as far as public services are concerned, the costs of services provided by the city are commonly completely borne by the inhabitants of the city. Since less services are provided by the village than by the cities, inhabitants of cities usually benefit to a much smaller extent from the services provided in villages than villagers benefit from cities' services, representatives of cities have claimed that the distribution of the tax burden is unfair. Moreover, the interjurisdictional spillover effects of public good provision may give rise to severe underprovision as voters in the city do not take into account the benefits of the city's public good provision on the welfare of the villagers. The same holds for the public good provision in the village in as far as urbanites benefit from public good provision in the village.

A natural policy response to these problems is to unify cities and villages. Unsurprisingly, inhabitants of villages often fiercely oppose unification as it entails a large tax increase. Villagers claim that the only goal of unification is to relieve the financial problems of the city. Moreover, they fear that their interests will be ignored because they constitute a minority in political decision-making bodies after unification. Consequently, public good provision in the village may be reduced. When villagers have the right to decide on whether to unite with a city or not, unification will therefore be a rare event.

This chapter studies how national transfers to local governments can resolve these problems. We analyze a simple model of local public good provision in a country consisting of a large number of heterogeneous regions. Each region consists of two districts that differ in size, a city and a village. The city and the village either form one municipality or they remain autonomous. We assume that unification requires the consent of a majority of voters in both the city and in the village. In line with earlier studies, we find that when districts remain autonomous, there is underprovision of local public goods in

both districts. Underprovision of public goods in the village persists after unification, and may even become more severe. In the city, unification results in overprovision of public goods, as the urbanites start exploiting the villagers. Lastly, our model implies that from a social welfare point of view, voters in the village have insufficient incentives to vote for unification.

We consider the effects of two types of national transfers: an earmarked transfer that increases with local public good provision and a lump-sum transfer to municipalities that is independent of population size. An earmarked subsidy helps to mitigate the underprovision problem. A lump-sum transfer that is negative strengthens the incentives for unification. Heterogeneity between regions causes neither of these transfers to attain the first-best. Earmarked transfers promote welfare as they increase public goods provision in autonomous districts, but exacerbate the problem of overprovision of public goods in cities that merged with a village. Moreover, even when all districts remain autonomous, differences in the size of the spillover effect between regions cause earmarked transfers to result in overprovision in some regions, while underprovision persists in other regions. A lump-sum tax that is independent of population size promotes unification in regions where it is socially desirable, but also in regions where districts can better remain autonomous. The optimal lump-sum transfer as well as the optimal earmarked transfer entail a trade off between these desired and undesired effects and crucially depend on the exact distribution of relative population sizes and spillover effects over regions.

Transfers from national governments to local governments are widespread. For instance, in The Netherlands, about 7% of the national government budget is transferred to local governments through the 'Gemeentefonds'. Parts of these transfers are earmarked. In Germany, the 'Gemeindefinanzierungsgesetz' arranges the transfers from the 'Länder' to the 'Kommunen'. In Sweden, local governments receive general grants and equalization grants from the 'staten'. In the US, towns receive intergovernmental grants from the federal government, from the state, and from the county.

The economics literature gives little attention to the effect of transfers on incentives for unification.[1] One reason is that most papers on political geography focus on formation of countries rather than on unification of local jurisdictions. Related to this chapter are Alesina and Spolaore (1997), Bolton and Roland (1996, 1997), and to the research presented in Chapter 2.[2] In contrast to the present analysis, these papers assume that centralized policy is uniform. Our set-up is close to Besley and Coate (2003), who study the merits of centralized provision of local public goods when provision need not be uniform across jurisdictions. The main differences between the analysis presented in this chapter and their analysis is that we endogenize the decision on centralization and that we allow for transfers from a higher-level government.

Three other papers are close to our analysis. First, Calabrese, Cassidy, and Epple (2002) develop a computational model to study the effects of and political support for

[1]There is, however, a large literature on intergovernmental transfers where jurisdictional boundaries are taken as given, most prominently Oates (1972), Gordon (1983), Persson and Tabellini (1996), and Dixit and Londregan (1998). For a survey, see Oates (1999).

[2]For a survey of the literature on the size of countries, see Bolton, Roland and Spolaore (1996).

municipal consolidation. Their main focus is on local redistributive policies and housing prices. Ellingsen (1998) studies the effects of inter- and intra-regional heterogeneity in preferences and the relative size of regions on political integration. Heterogeneity in preferences between regions also plays a key role in Lockwood (2002). None of these papers examines the role of transfers from a national government. Although Snoddon and Wen (2003) look at these intergovernmental transfers, they do not look at the incentives for unification.

The analysis presented in this chapter thus differs from the existing work in the following important ways. Firstly, in the papers on political geography, like Alesina and Spolaore (1997), Bolton and Roland (1996, 1997) and in the research presented in Chapter 2, centralized policy is uniform. In our analysis, centralized decision making does not exclude decentralized public good provision and this is in line with what we observe in reality. Secondly, we look at endogenous decisions on centralization, which is missing in for example Besley and Coate (2003) and Snoddon and Wen (2003). Thirdly, papers like Calabrese, Cassidy and Epple (2002), Ellingsen (1998) and Lockwood (2002) do not look at transfers from a national government, although these transfers are widespread and we take them therefore into account. The existing literature thus does not discuss the interplay between the local decisions on centralization and on public good provision on the one hand and intergovernmental transfers on the other.

The remainder of this chapter is organized as follows. Section 5.2 presents the basic model. The analysis of the model is in Section 5.3, Section 5.3.1, derives the socially optimal amounts of local public goods, Section 5.3.2 examines the outcome of voting on public good provision, when districts are autonomous and when they are united, and Section 5.3.3 derives the conditions under which districts decide to unite. In Section 5.3.4 these conditions are compared with the conditions for socially optimal unification. Section 5.4 examines the effects of national transfers to municipalities. Section 5.5 concludes.

5.2 The model

Consider a country consisting of many regions. Each region consists of two districts (cities, villages). Districts in a region differ from each other in population size; otherwise they are identical. The population size of district i in region j is denoted by α_{ij}. Inhabitants of a district are homogenous and immobile.

Districts in a region either form one municipality or two separate municipalities. Forming one municipality requires majority support in each of the districts. A municipality is responsible for the provision of local pure public goods. Decisions on public goods provision are taken by majority rule. The amount of public goods provided in district i in region j is denoted by g_{ij}. Public goods provided in a district have positive spillover effects on the other district in the region. The utility function of an inhabitant of district i in region j is:

$$U_{ij} = \sqrt{g_{ij}} + \kappa\sqrt{g_{-ij}} + y - t_{ij} \tag{5.1}$$

where g_{-ij} is the amount of public goods provided in the other district in region j, the parameter $\kappa \in [0, 1]$ measures the degree of spillovers, y is before-tax private income per

capita, and t_{ij} is a local lump-sum tax. Note that we abstract from income heterogeneity. Further, we assume that public goods and private goods are separable in the utility function and that taxes are nondistortionary. A convenient implication is that we can omit y. We will discuss some of the consequences of these assumptions along the way and in the concluding section.

The cost of a public good is equal to p units of private goods. Public goods are financed by local lump-sum taxes, t_{ij}, and by transfers from the central government to the local governments, $f(\cdot)$. The latter may depend on, e.g., the population size of the municipality and on the amount of public goods provided. If districts in region j are two separate municipalities, the local government's budget constraint reads:

$$pg_{ij} = f(\cdot) + t_{ij}\alpha_{ij} \tag{5.2}$$

If districts in region j form one municipality, the budget constraint is:

$$p(g_{ij} + g_{-ij}) = f(\cdot) + t_j(\alpha_{ij} + \alpha_{-ij}) \tag{5.3}$$

Note that we impose the condition that the per capita taxes within a municipality are uniform across districts.

5.3 Public good provision and unification

We structure our analysis as follows. First, we derive the socially optimal levels of local public goods. Next, we analyze political decision making and contrast the outcomes with the normative benchmark. The political decision making process consists of two stages. First, voters in each district vote on whether to unite with the neighboring district into one municipality or to remain autonomous. Next, there is a vote on the amount(s) of public goods in each municipality. For the moment, we abstract from central funding, $f(\cdot) = 0$. In section 4, we study national transfers aimed at improving the allocative efficiency of local public good provision in heterogenous regions. Since we abstract from interregional spillovers, and inhabitants are immobile, we restrict attention in this section to public goods provision and unification of municipalities in a particular region. For convenience, we drop the subscript j, and we denote the larger district in the region as the city (c) and the smaller district as the village (v), $\alpha_c > \alpha_v$.

5.3.1 Social optimum

We define the social optimum as the outcome that maximizes the unweighted sum of utilities of all individuals in the region:

$$\max_{g_c, g_v} \alpha_c(\sqrt{g_c} + \kappa\sqrt{g_v}) + \alpha_v(\sqrt{g_v} + \kappa\sqrt{g_c}) - pg_c - pg_v \tag{5.4}$$

The social surplus maximizing public good levels (g_c^s, g_v^s) that result from this optimization problem are:

$$g_c^s = \left(\frac{\alpha_c + \kappa\alpha_v}{2p}\right)^2 \tag{5.5}$$

$$g_v^s = \left(\frac{\alpha_v + \kappa\alpha_c}{2p}\right)^2 \tag{5.6}$$

Hence, the socially optimal amount of public goods in each district increases in the population size of both districts, increases in the size of the spillover effect, and decreases in the cost of public goods provision.

5.3.2 Voting on public goods provision

First consider the case where districts remain autonomous. Recall that voters are homogenous within districts. Hence, the outcome of voting in district i is found by maximizing (5.1) with respect to g_i subject to the budget constraint (5.2). The equilibrium levels of public goods (g_c^a, g_v^a) are:

$$g_c^a = \left(\frac{\alpha_c}{2p}\right)^2 \tag{5.7}$$

$$g_v^a = \left(\frac{\alpha_v}{2p}\right)^2 \tag{5.8}$$

Clearly, local public goods are underprovided when districts are autonomous [compare (5.7) and (5.8) with (5.5) and (5.6), respectively]. The reason is that voters in each district do not take into account the positive spillover effect of public goods on welfare in the other district. Underprovision is more severe for larger spillover effects and for a larger population size of the neighboring district.

When districts unite into one municipality, the inhabitants of the city are in a majority and, therefore, g_c and g_v are set according to their wishes. Maximizing (5.1) with respect to g_c and g_v subject to the budget constraint (5.3) results in:

$$g_c^u = \left(\frac{\alpha_c + \alpha_v}{2p}\right)^2 \tag{5.9}$$

$$g_v^u = \left(\frac{\kappa\left(\alpha_c + \alpha_v\right)}{2p}\right)^2 \tag{5.10}$$

Unification results in overprovision of public goods in the city, whereas underprovision of public goods in the village persists and may become even more severe than under autonomy [compare (5.9) and (5.10) with (5.5) and (5.6) and with (5.7) and (5.8), respectively]. The intuition is clear. Unification broadens the tax base. Hence, the per capita tax per unit of public good is lower. This induces inhabitants of the city (the decisive voters) to increase the amount of public goods provided in their district. Since they do not take into account the tax cost to the inhabitants of the village, and the villagers benefit less from public goods provided in the city than the urbanites, public goods provision in the city is higher than socially optimal. The effect of unification on the amount of public goods provided in the village is ambiguous. On the one hand, the per capita tax per unit of public good decreases, resulting in an increase in the amount of public goods provided. This effect is larger for a larger population size of the city. On the other hand, it is the

urbanites, not the villagers, who decide on public goods provision after unification. This reduces the amount of public goods provided in the village as urbanites care less about the public goods in the village than do the villagers. This effect is larger for a smaller spillover effect. Comparing (5.10) with (5.8), it follows that unification increases public goods supply in the village if $\kappa > \frac{\alpha_v}{\alpha_c+\alpha_v}$. Hence, public goods supply in the village increases if the spillover effect or the relative population size of the city is sufficiently large. Since $\alpha_v < \alpha_c$, $\kappa \geq \frac{1}{2}$ is a sufficient condition. In all cases, underprovision of public goods persists in the village as inhabitants of the city care less than the inhabitants of the village about public goods supply in the village [compare (5.10) with (5.6)].

Lastly, it is easily verified that the per capita tax is always higher when districts unite than when they remain autonomous and - in the latter case - that the tax in the city is higher than the tax in the village:

$$t_v^u = t_c^u = \left(1+\kappa^2\right)\frac{\alpha_c+\alpha_v}{4p} > t_c^a = \frac{\alpha_c}{4p} > t_v^a = \frac{\alpha_v}{4p}$$

Clearly, when public and private goods would not be separable in the utility function, this need not be the case because income effects come into play.

5.3.3 Voting on unification of municipalities

In each district, there is a vote on whether to unite with the neighboring district into one municipality or to remain autonomous. Using the results from the previous subsection, urbanites favor unification if:

$$\left(1+\kappa^2\right)\frac{\alpha_c+\alpha_v}{2p} > \frac{\alpha_c}{4p} + \kappa\frac{\alpha_v}{2p}$$

Unsurprisingly, this condition is always satisfied. Unification benefits the inhabitants of the city as it brings about a broader tax base and the right to decide on the level of g_v. Villagers favor unification if:

$$\left(4\kappa-\kappa^2-1\right)\frac{\alpha_c+\alpha_v}{4p} > \frac{\alpha_v}{4p} + \kappa\frac{\alpha_c}{2p}$$

Rewriting yields:

$$\left(4\kappa-\kappa^2-2\right)\alpha_v > \left(1+\kappa^2-2\kappa\right)\alpha_c \tag{5.11}$$

The right-hand side is positive for all values of κ between zero and unity. The left-hand side is negative when $\kappa \in [0, 2-\sqrt{2})$. Hence, when the spillover effect is small, villagers oppose unification for any values of α_v and α_c. For $\kappa > 2-\sqrt{2}$, we can write the condition as:

$$\frac{\alpha_v}{\alpha_c} > \frac{1+\kappa^2-2\kappa}{4\kappa-\kappa^2-2} \tag{5.12}$$

This condition is depicted in Figure 5.1.
Unification can only be in the villager's interest if $\kappa > 3/2 - \frac{1}{2}\sqrt{3}$. The villagers' incentive to unite becomes stronger as the spillover effect is larger. The intuition is clear. After unification, public goods provision reflects the wishes of the urbanites. When spillovers are

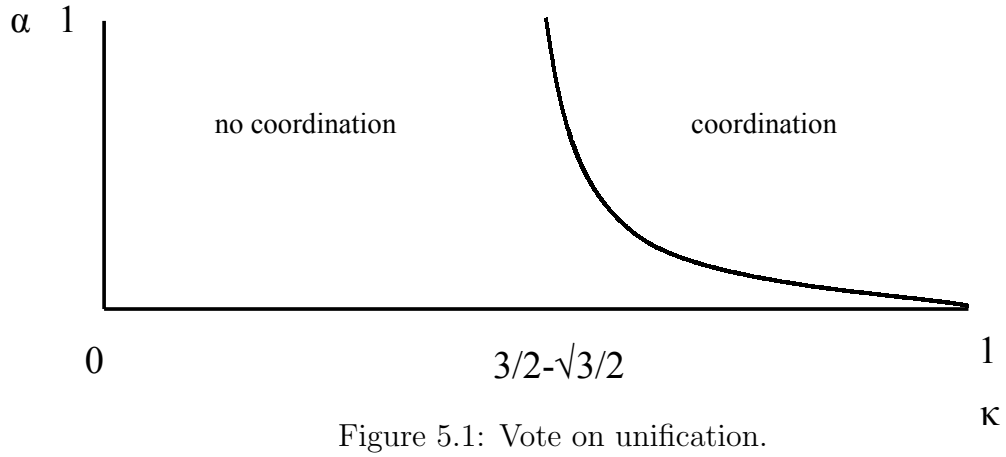

Figure 5.1: Vote on unification.

small, unification reduces the level of public goods that are provided in the village while the tax burden increases as villagers now have to pay for the public goods provided in the city. In addition, when spillovers are small, villagers benefit little from the increase in public goods supply in the city. When spillovers are larger, unification may increase public goods provision in the village and villagers benefit to a larger extent from the increase in public goods provision in the city. If spillovers are sufficiently large, the welfare gain from the increase in public goods compensates for the increase in the tax.

More surprisingly, provided that $\kappa > 2 - \sqrt{2}$, the incentive to unite increases in the relative size of the village, while the reverse holds when $\kappa < 2 - \sqrt{2}$. Two effects, working in opposite directions, play a role.

First, the villagers must pay for the public goods that are provided in the city when they decide to unite, while they can free ride on the city's tax payers when they remain autonomous. The larger is the city's population size, the larger is the tax increase for the villagers. A larger population size in the city thus weakens the incentive to unite. Unification, however, also increases the amount of public goods provided in the city as it broadens the tax base. This effect increases in the population size of the village. If $\kappa < \frac{1}{2}$, the positive effect of higher public good provision in the city on villagers' utility does not compensate for the accompanied increase in the tax burden. Then, a larger population size in the village reduces the incentive to unite. If $\kappa > \frac{1}{2}$, the villagers' benefit from increased public good provision in the city is larger than the utility loss from the tax increase. Then, a larger population size in the village makes it more likely that villagers support unification.

Second, for any value of κ, a higher population size in the city promotes unification as it becomes more likely that public goods provision in the village increases. In contrast, the more populous the village, the weaker the incentive to unite. When the village is large, the level of public goods under autonomy is already high and, hence, it becomes less likely that unification results in an increase in public goods provision in the village.

Taking the two effects together, it follows that the incentive to unite decreases in the relative size of the village when spillovers are small ($\kappa < 2 - \sqrt{2}$), while the reverse holds when spillovers are large ($\kappa > 2 - \sqrt{2}$).

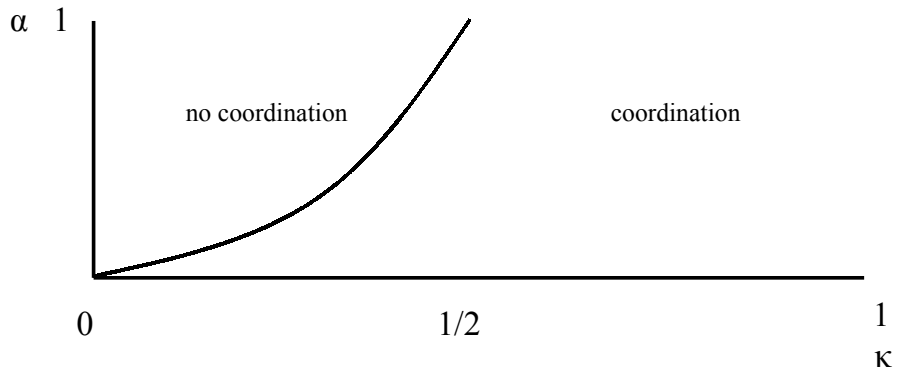

Figure 5.2: Social optimality and political feasibility of unification.

5.3.4 Socially optimal unification

Unification is only in the villagers' interest when spillovers are large and the village is not too small relative to the city. An important question is under what conditions unification brings us closer to the social optimum. In other words, do villagers have sufficient incentives to vote for unification from a social welfare point of view? Comparing social welfare under autonomy and unification, we find that unification raises welfare if:

$$\alpha_v^2\left(2-4\kappa+\kappa^2\right)-\kappa^2\alpha_c^2<0$$

When $\kappa > 2-\sqrt{2}$, the first term is negative and, hence, unification always increases social welfare. When $\kappa < 2-\sqrt{2}$, we can write the condition as:

$$\frac{\alpha_v}{\alpha_c}<\frac{\kappa}{\sqrt{2-4\kappa+\kappa^2}} \tag{5.13}$$

This condition is depicted in Figure 5.2, together with the political feasibility constraint which we derived in the previous section.
Unification increases welfare if the spillover effect is sufficiently large. If $\kappa > \frac{1}{2}$, unification always increases welfare. A large spillover effect implies that underprovision is severe under autonomy and makes it more likely that public goods supply in both the city and the village increase after unification. When the spillover effect is small, unification only increases aggregate welfare if the village is small relative to the city. The intuition is straightforward. The smaller the village, the smaller the increase in the tax base, and hence the less severe the overprovision of public goods in the city after unification. Moreover, when the village is small relative to the city, it is more likely that unification increases public good provision in the village, and hence partly resolves the underprovision problem in the village. Clearly, villagers' incentives to vote for unification are insufficient from a social welfare point of view. The reason is that they do not take into account the effect of unification on the welfare of the urbanites.

5.4 National government

The previous section showed that: i) autonomous districts underprovide public goods; ii) unification does not solve (may even worsen) the problem of underprovision in the

smallest district and results in overprovision in the largest district; iii) voters in the smallest district have insufficient incentives to vote for unification from a social welfare point of view. This section examines how the national government may improve upon the decentralized equilibrium outcome by conditioning national transfers to municipalities on local characteristics. We assume that the national government can condition transfers to municipalities on population size and on the levels of public goods that are provided. The national government does not observe the size of the spillover effect in different regions. If it could condition transfers also on the size of the spillover effect, the national government could generate any level of public good provision (including first-best provision in all districts) without creating any distortions. We feel that it is plausible to assume that the national government lacks information about spillover effects in different regions. We analyze the effects of two types of transfers: i) a transfer that is conditional on the level of public goods and that must be spent on public goods (earmarked transfers) and ii) a lump-sum transfer per municipality. The earmarked transfer helps mitigating the underprovision problem. The lump-sum transfer affects the incentives for unification and may thus indirectly increase the allocative efficiency of public goods provision in the economy.

5.4.1 Earmarked transfer

The national government gives a transfer of σ per unit of public good provided in each municipality. The transfer is earmarked: it must be spent on the same public good that it is conditioned on. The national government finances the subsidy to local public good provision by means of a national income tax. We assume that the number of municipalities is sufficiently large, such that a single municipality's decisions have a negligible effect on the national tax rate. Hence, we can safely ignore the national tax in the analysis of local public goods provision and unification of municipalities.

First consider autonomous districts. Maximizing (5.1) with respect to g_i, subject to the budget constraint (5.2), and recognizing that each unit of g_i delivers $(1+\sigma)\, g_i$ through the transfer scheme, results in the equilibrium level of public goods provision:

$$g_i^a = \left(\frac{(1+\sigma)\, \alpha_i}{2p} \right)^2 \tag{5.14}$$

Comparing (5.7) with (5.14), it follows that the level of public goods increases in the earmarked transfer. Similarly, when districts unite, public goods provision in equilibrium is:

$$\begin{aligned} g_c^u &= \left(\frac{(1+\sigma)\, (\alpha_c + \alpha_v)}{2p} \right)^2 \\ g_v^u &= \left(\frac{(1+\sigma)\, \kappa_j\, (\alpha_c + \alpha_v)}{2p} \right)^2 \end{aligned}$$

It is easily verified that the earmarked transfer does not affect the incentives to unite. The reason is that the transfer σ increases welfare under the different regimes equiproportionally. For the same reason, the condition under which unification is socially optimal is not affected by the level of the earmarked transfer.

Earmarked transfers do not bring about socially optimal public goods provision for at least two reasons. First, in regions where districts have merged, earmarked transfers aggravate the problem of overprovision of public goods in the largest district. Second, when spillover effects differ between regions, a given level of σ is too low in some regions, while it is too high in others. Hence, underprovision will persist in some regions, while earmarked transfers cause overprovision in other regions.[3] The optimal level of σ will crucially depend on the exact distribution of κ_j's over regions as well as on the distribution of $\frac{\alpha_v}{\alpha_c}$ over regions.

5.4.2 Lump-sum transfer

Another, less direct way to enhance allocative efficiency of public goods provision is to promote unification of districts. As we saw in the previous section, the villagers have insufficient incentive to unite from a social welfare point of view. A simple way to alter the incentives to unite is to make a lump-sum transfer.[4] Suppose the national government provides a lump-sum transfer μ to each municipality. Villagers favor unification if:

$$\left(4\kappa_j - \kappa_j^2 - 1\right)\frac{\alpha_c + \alpha_v}{4p} + \frac{\mu}{\alpha_c + \alpha_v} > \frac{\alpha_v}{4p} + \kappa_j\frac{\alpha_c}{2p} + \frac{\mu}{\alpha_v}$$

Clearly, $\mu < 0$ promotes unification and since this lump-sum transfer is negative, we also call it a lump-sum tax. A lump-sum tax which is equal for all municipalities makes it more likely that villagers support unification as unification enables them to share this tax with more people. Just like the earmarked transfer, the lump-sum transfer is not a distortion-free instrument. Since the national government does not observe κ_j, the lump-sum tax is either too low to induce unification in all cases in which unification is socially desirable, and/or the lump-sum tax is so high that some small villages have an incentive to unite while it would be socially optimal to remain autonomous. The optimal lump-sum transfer entails a trade off between these two effects and will crucially depend on the exact distribution of κ_j over regions.

5.5 Concluding remarks

In this chapter we presented a model to study local public goods provision, endogenous formation of municipalities, and the effects of transfers from higher-level governments. A well-known result is that decentralized public good provision leads to underprovision when there are positive spillovers. We have shown that centralized public good provision may lead to overprovision of local public goods in the largest district. Moreover, when

[3]Conditioning σ on the population size of municipalities may help, but does not eliminate these problems because of the differences in κ between regions.

[4]There exist more sophisticated transfer schemes to manipulate the incentives to unite, where the transfers depend on the (relative) size of the village. Given that κ is not observed by the national government, none of them will bring about the social optimum, however. As for the earmarked transfer, the optimal scheme is dependent of the exact distribution of κ over regions. We have attempted to derive optimal transfer schemes for specific distributions, but we either failed to obtain a solution or felt that the solution did not bring much additional insights.

the spillover benefits are small, centralized provision may aggravate underprovision in the smallest district. As a rule, there are insufficient incentives for unification in the smallest district. A national government can alleviate above-mentioned problems by implementing a transfer scheme. We have considered an earmarked transfer, acting upon the amounts of local public goods provided, and a lump-sum transfer, affecting the incentives for unification. When the national government is not fully informed about local preferences, these transfers do not bring about the social optimum. Optimal transfers depend crucially on the distribution of spillover effects over regions.

Our analysis can be extended in several important ways. Firstly, one could drop the assumption that individuals are immobile, and introduce a housing market, as in Calabrese, Cassidy, and Epple (2002). When mobility is costless, housing prices in market equilibrium will be such that the utility of urbanites and citizens is equal. The welfare effects of unification of the city and the village will then be reflected in a change in relative housing prices. We conjecture that our main results will still hold after this modification. A nice feature of this extension is that it could yield hypotheses that can be empirically tested using housing prices before and after unification of municipalities.

Secondly, a threat of secession and the possibility of bargaining between the municipalities could be introduced in the model. Before unification, the urbanites and villagers could attempt to agree upon levels of taxation and public goods provision, which can be different from the unrestricted majority voting outcome. Compliance might be enforced by the threat of secession by one of the districts.[5] It is clear that bargaining would make unification politically feasible for most, if not all, of the cases where unification is socially optimal. In fact, there would be no need to unify municipalities, coordinating public good supply would suffice. As Inman and Rubinfeld (1997) note and anecdotical evidence suggests, however, the overall record of 'cooperative federalism' has not been impressive.

Thirdly, we have restricted our analysis to the issue of what would be a socially optimal transfer scheme. Obviously, policy makers at the central level who decide on the transfers may have other interests, either because they represent mainly urbanites (or villagers), or because they are responsive to lobbying efforts by local governments, as in Borck and Owings (2003), or because they can use intergovernmental grants to win votes in districts with many swing voters, as in Johansson (1999). It would be interesting to examine the interplay between political decision making at the central level and at the local level, taking into account the inefficiencies in local political decision making that we identified in this chapter. Likewise, politicians and voters at the local level may have other motives for unification than those stressed in this chapter. Austin (1999) shows that the current decisive voter may support unification so as to influence the identity of the decisive voter in the future. His empirical analysis suggests that these political motives may be more important than economic motives. Filer and Kenny (1980), on the other hand, do find evidence that voters vote in line with their dollar benefits of unification.

Lastly, the model could be extended so as to capture a number of other features that appear to be important in political decision making on unification of municipalities and local public good provision, like asymmetric spillovers (urbanites usually benefit less from public goods provision in the village than villagers benefit from the city's public

[5]Le Breton and Weber (2003) have recently developed a model where transfers are used to prevent secession by regions.

goods), income heterogeneity, and economies of scale in public good production. While the latter may imply that inhabitants of small villages are more favorable to unification than suggested by our analysis, the former two tend to strengthen the villager's opposition.

Part III

Violence

Chapter 6

Violence and secessionism

6.1 Introduction

There are several examples in the world where secessionism and terrorism are linked, like Tamil Eelam in Sri Lanka, Palestine and Israel, Basque country in Spain and Northern Ireland in the United Kingdom. This chapter studies the incentives of the terrorists and of the other groups which are involved in these conflicts.

When individuals are willing to use violence to reach a certain goal, they clearly are extreme in their methods. Next to this, individuals can also be, what I call, extreme in their objectives. For example, one of the most active Palestinian terroristic organizations, Hamas, is also extreme in their objectives. In articles 11 to 13 of their covenant[1] it is stated that the claim is on the land between the Mediterranean and the Jordan river, not just the parts within the 1949-1967 Armistice lines. Next to this, the covenant is written as a religious document, leaving very little room for negotiations. This contrasts with other examples, like the ETA[2] in Basque Country or the IRA in Northern Ireland, where terroristic organizations put a claim only on parts of the state involved. To distinguish between the cases, I call the latter extremists, and the former radical extremists.

Apart from looking at the incentives of terrorists, the extremists or radical extremists, I also look at the incentives of three other groups, the public, the government and the moderates. The moderates and the extremists both live in a disputed -or occupied- territory. This territory is occupied by the government, which is elected by the public. The extremists can choose an effort level to conduct terror, while the moderates can choose to suppress terror. Both want to end the occupation. The government is formed by one of two parties, and parties are interested in being reelected, while the public is interested in avoiding terrorist attacks.

The main findings of the model are the following. By assumption, it is beneficial for the moderates to suppress terror and it follows that these incentives to suppress terror are larger when there is a larger probability of ending the occupation. This increases the probability of ending the occupation, leading to a further increase in the expected payoffs of the moderates. Radical extremists oppose a compromise, so when there is a

[1] See Hamas (1988).

[2] For a description of the ETA and the economic consequences of terrorism for Basque country, see Abadie and Gardeazabal (2003).

high probability of ending the occupation, they choose a higher effort level to conduct to terror. This higher effort level decreases the probability of reaching a compromise and thus increases the expected payoffs of the radical extremists. Extremists who are not radical on the contrary do not oppose a compromise. When there is a high probability of ending the occupation, extremists of this type therefore choose a low effort level to conduct terror to make the ending of independence more likely and to increase their expected payoff. A policy implication is that with radical extremists, it is important to implement a compromise in a fast and credible way. The credibility meant is that the compromise cannot be withdrawn by a government. Another implication is that with extremists that are not radical a more gradual implementation of a compromise is less of a problem than with radical extremists, especially as long as the moderates have the right to decide on the status of the territory.

In the political economy literature, a discrete-time dynamic optimization approach is also used by Acemoglu and Robinson (2000,2001), dealing with the franchise, and by Berrebi and Klor (2004), investigating the interaction between terrorist attacks and electoral outcomes in Israel. In the paper by Berrebi and Klor the model is similar but more specific for the Israel/Palestine case, making the conclusions based on the theoretical model less general. One of their hypotheses following from their theoretical analysis is that the expected level of terrorism is higher when a lenient (leftish) government is in power, and they give some evidence for this result that also follows from the analysis presented in this chapter. The analysis by Berrebi and Klor and in this chapter follows from the terrorists' strategic consideration and not from deterrence policies chosen by the government. For a study of the effect of deterrence policies and of retaliation in the Israeli-Palestinian case, see Brophy-Baermann and Conybeare (1994).

A static game theory-model with a similar prediction as posed in the paper by Berrebi and Klor is used by Kydd and Walter (2002). In the model, for the moderates trustworthiness and ability play a role while for the government it is important whether it is lenient or not. Kydd and Walter also present some evidence that Hamas plans attacks when there is a high probability of reaching an agreement and that a lenient -Labor- government is more ready to cooperate. This evidence is in line with some of the predictions and assumptions in this model.

Some related topics are how a violent group deals with the problem of defection, i.e. principal-agent problem, and why when there are shared characteristics one observes violence in some cases and not in other cases. Radical religious militia are discussed by Berman (2003), using a club good framework to explain the attraction of organizations which are demanding sacrifices. The analysis gives an explanation how these extreme organizations may overcome principal-agent problems. De Figueiredo and Weingast (2001) propose a model explaining terrorist and anti-terrorist behavior. It gives an explanation for both cross-sectional and dynamic variation among cases in which the possibility of terrorism exist, but it does not explicitly look at how the incentives to conduct terror are related to the probability of reaching a compromise.

In the remaining of this Chapter I start with discussing the model and its assumptions in Section 6.2. Section 6.3 studies the decision by the moderates whether to suppress terror. Section 6.4 looks at the incentives of radical extremists to conduct terror, while

Section 6.5 does the same for extremists. Section 6.6 discusses the possibility of granting autonomy instead of independence to the disputed territory and Section 6.7 concludes with policy implications and some suggestions for further research, while most proofs are in the Appendix.

6.2 The model

In the model, there are four agents which are called the public (P), the government (G), the moderates (M) and the extremists (E). I treat all agents in a given group as identical. The government, which is elected by the public, occupies a certain territory. This territory is claimed by a different group of individuals consisting of two subgroups, the moderates and the extremists.

The dynamic model has an infinite time horizon, where time is discrete, $t = 0, 1, 2, ...$ All players discount the future using the same discount factor $\delta \in (0, 1)$.

The elected government x in period t is either lenient government ($x_t = l$) -a left-wing government- or non-lenient government ($x_t = r$) -a right-wing government-. A lenient government will grant independence (in) to the territory if the realized level of terror (τ) is low ($\tau = \tau_l$) but not when the realized level of terror is high ($\tau = \tau_h$). A lenient government is in principle willing to grant independence, but when there is much violence this is not feasible due to for example a lack of trust. A non-lenient government always continues the occupation (oc). Independence is an absorbing state, once granted it cannot be withdrawn.

The moderates either do not suppress terror ($s = 0$) or they do suppress terror ($s = 1$) but whether they suppress terror is not observed by the others. The extremists can choose a high effort level $\overline{e}$ or a low effort level $\underline{e}$. The expectation of the public in period t of the probability of having a high level of terrorism (p_t) is either small (p^l) or high (p^h) and logically, $p^l < p^h$.

The payoffs of the public depend on the status of the disputed territory ($y = in, oc$) and on the perceived level of terror $\tau = \tau_l, \tau_h$. I assume that individuals in the public prefer a low level of terror over a high level, independent of the status of the disputed territory, while the individuals prefer to continue the occupation, for a given level of terror. Continuing the occupation, however, is not preferred when the level of terror can be reduced by ending it. Safety is thus important for the public, for obvious reasons. The preference for continuing the occupation can be explained by for example the importance to control natural resources or the fear that ending the occupation leads to a further disintegration of the country. Examples of natural resources are water sources in the Israel/Palestine case or diamonds in the Tamil Eelam/Sri Lanka case while an individual in Spain may fear further political disintegration when Basque country becomes independent.

The public is thus interested in safety, that is, in a low level of terrorism. The public's expectations on future levels of terrorism are shaped by the most recent level of terrorism. That is, when the perceived level of terror τ in period t is τ_l, then $p_t = p^l$ and when $\tau = \tau_h$ in period t then $p_t = p^h$. At the end of each period t the public elects a government $x_{t+1} =$

$\{l, r\}$, where

$$x_{t+1} = \begin{cases} r & \begin{cases} \text{if } x_t = l \wedge p_t = p^h \\ \text{if } x_t = r \wedge p_t = p^l \end{cases} \\ l & else \end{cases} \tag{6.1}$$

In this retrospective voting process the public rewards (prolongs) a government when a low level of terrorism is realized, while it punishes (changes) a government when a high level of terror is realized.

The moderates' payoffs $u^M(.)$ depend on the status of the disputed territory ($y = in, oc$) and on their decision whether to suppress terror ($s = 1$) or not to suppress terror ($s = 0$). For the payoff of the moderates, I assume that the following two relations hold.

$$u^M(in, s) > u^M(oc, s) \qquad s = 0, 1 \tag{6.2}$$

$$u^M(y, k) = u^M(y) + sb \quad y = in, oc; s = 0, 1 \tag{6.3}$$

where $b > 0$ denotes the benefits for the moderates of suppressing terror. These benefits can be in terms of getting a better reputation, as foreign countries and international organizations do not want to connect to an organization which is associated with terrorism. The benefits can also be that suppressing a rival armed group implies that the moderates are gaining additional influence over the extremists. Inequality (6.2) implies that the moderates are better of when independence is granted, while equality (6.3) implies that it is beneficial for the moderates to suppress terror. The payoffs of the extremists depends on the type of extremism. The payoffs of radical extremists differ from the payoffs of extremists and are discussed separately in Sections 6.4 and 6.5 respectively.

The probability of having a low level of terror $Pr[\tau = \tau_l|.]$ depends on whether the moderates suppress terror or not ($s = 0, 1$) and on the effort level chosen by the extremists ($e = \underline{e}, \overline{e}$). For this probability I assume that the following holds.

$$\left.\begin{array}{l} Pr[\tau = \tau_l|s = 0, e = \overline{e}] = \alpha_1 \\ Pr[\tau = \tau_l|s = 1, e = \overline{e}] = \ Pr[\tau = \tau_l|s = 0, e = \underline{e}] = \alpha_2 \\ Pr[\tau = \tau_l|s = 1, e = \underline{e}] = \alpha_3 \end{array}\right\} \ \alpha_1 < \alpha_2 < \alpha_3 \tag{6.4}$$

Expression (6.4) implies that the probability of having a low level of terror is higher when the moderates suppress terror and higher when the extremists choose a low effort level.

The timing of the events within a period can be summarized as follows.

1. The type of government is observed by the public, the moderates and the extremists.
2. The moderates choose to suppress or not to suppress terrorism. The outcome of this decision is not observable.
3. The extremists choose a certain effort level to conduct terror. Just as the outcome of the moderates' decision, the outcome of the decision of the extremists is not observable.

4. A level of terror is realized, and this level is observed by all individuals.
5. The individuals in the public update their expectation on the probability of having a low level of terror.
6. A lenient government grants independence to the territory when the realized level of terror was low.
7. The public elects a government.

6.2.1 Definition of equilibrium

The equilibrium concept used is the one of Markov perfectness and player's choices in a period depend on the current state of the world and on the prior actions taken within the same period. Choices are made by the moderates or extremists and by the government. The moderates choose between suppressing or not suppressing terror, the extremists between a high or a low effort level to conduct terror while a lenient government might grant independence to the occupied territory.

The state of the system consists of the status of the disputed territory $y = (in, oc)$ and the type of government $x = (l, r)$. The choices made by the moderates and the extremists depend on both the status and the type, more formally, let $\sigma^M(x, y)$ denote the actions taken by the moderates and let $\sigma^E(x, y)$ denote the actions taken by the extremists when the state is $x = l$ or r and $y = in$ or oc. Then, a pure strategy Markov Perfect equilibrium is characterized by a strategy combination $\left\{\sigma^M(x, y), \sigma^E(x, y)\right\}$ such that σ^M and σ^E are best-responses to each other.

The equilibrium of the game can be characterized by writing the appropriate Bellman equations. Define $V^M(x, y|s, e)$ as the continuation value for the moderates, that is the discounted expected net present value of their payoffs. This continuation value depends on x, whether there is a lenient government, y the status of the territory, s, the decision to suppress terror and e, the effort level chosen by the extremists. When the territory is still occupied ($y = oc$) a lenient government grants autonomy when there is a low level of violence while a non-lenient government never grants autonomy. A high level of violence results in a change of the type of government in the next period. Therefore, the values of the moderates are given by

$$\begin{aligned} V^M(l, oc|\sigma^M, \sigma^E) = & \\ u^M(oc) + sb + & \quad \delta\Big[Pr[\tau_l|\sigma^M, \sigma^E]V^M(l, in|\sigma^M, \sigma^E) + \\ & \quad (1 - Pr[\tau_l|\sigma^M, \sigma^E])V^M(r, oc|\sigma^M, \sigma^E)\Big] \end{aligned} \tag{6.5}$$

and

$$\begin{aligned} V^M(r, oc|\sigma^M, \sigma^E) = & \\ u^M(oc) + sb + & \quad \delta\Big[Pr[\tau_l|\sigma^M, \sigma^E]V^M(r, oc|\sigma^M, \sigma^E) + \\ & \quad (1 - Pr[\tau_l|\sigma^M, \sigma^E])V^M(l, oc|\sigma^M, \sigma^E)\Big] \end{aligned} \tag{6.6}$$

where $s = 0$ if σ^M implies that the moderates do not suppress and $s = 1$ if σ^M implies that the moderates suppress terror. The Bellman equations for radical extremists and extremists are given separately in Sections 6.4 and 6.5 respectively.

6.3 Moderates

This section looks at incentives of the moderates. Throughout the section I assume that the extremists choose a high effort level. When the extremists choose a low effort level, the results do not change qualitatively. I characterize and discuss the equilibrium strategy of the moderates in this section and in Sections 6.4 and 6.5 the equilibrium strategies of the extremists are studied.

By assumption, there are positive benefits from suppressing terror and therefore the moderates always suppress terror once independence is granted. Apart from suppressing terror, the payoff of the moderates is influenced by the status of the disputed territory. When the territory is still occupied, the payoff also depends on whether there is a lenient government in power since a lenient government may grant independence while a non-lenient government will not. The next Proposition summarizes the moderates' actions in a pure strategy Markov equilibrium of the game. For expressions that implicitly give the cutoff values in the Proposition, see the derivations in the Appendix of this chapter.

Proposition 6.3.1. *There exist cutoff values $b^* < 0$ and $b^{**} > 0$ such that: (i) When $x = l$ and $y = oc$, the moderates will suppress terrorism if $b > b^*$; (ii) When $x = r$ and $y = oc$, the moderates will suppress terrorism if $b > b^{**}$; (iii) When $y = in$ the moderates will suppress terror.*

From Proposition 6.3.1 it follows that the decision the moderates face depends on the type of the government when the territory is still occupied. When a lenient government is in power, moderates have an incentive to suppress terror to increase the probability of getting independence while when a non-lenient government is in power, the moderates have an incentive not to suppress terror to increase the probability that this government is replaced by a lenient one. In the case with a lenient government, part (i) of the Proposition implies that even when suppressing terror is costly, the moderates will suppress terror, while suppressing becomes more likely if the degree of successfulness of suppressing terror is higher or if the continuation value due to independence is higher. In the case with a non-lenient government, part (ii) implies that the moderates will only suppress terror if this is very beneficial for them, while suppressing becomes less likely when the moderates care more about the future, when the degree of successfulness of suppressing terror is higher or when the improvement of having a lenient government is larger.

6.4 Radical extremism

This section looks at the incentives of radical extremists. Radical extremists are willing to use violence to reach objectives which are unacceptable for the public and the government. In the analysis of this section, the strategy of the moderates is similar to the one found in Section 6.3, so I assume that $0 < b < b^{**}$. This implies that the moderates

suppress terror when the disputed territory got its independence or when there is a lenient government. The extremists can choose either a high effort level ($\overline{e}$) or a low effort level ($\underline{e}$) for conducting terror, where $\underline{e} < \overline{e}$.

The extremists' payoffs $u^E(.)$ depend on the status of the disputed territory ($y = in, oc$) and on the effort level ($e = \{\underline{e}, \overline{e}\}$) chosen to conduct terror. For the payoff of of the extremists, I assume that the following two relations hold,

$$u^E(in, e_1) < u^E(oc, e_2) \qquad e_1, e_2 \in \{\underline{e}, \overline{e}\} \tag{6.7}$$

$$u^E(y, e) = u^E(y) - ec \quad y = in, oc; e = \underline{e}, \overline{e} \tag{6.8}$$

where $c > 0$ denotes the costs of choosing a high effort level or a low effort level. Inequality (6.7) implies that the extremists are better of when independence is not granted, while inequality (6.8) implies that it is more costly for the extremists to choose a high effort level to conduct terror. The extremists may dislike independence for two reasons. The first one is that they deny the right of existence of the government, the second is that independence is such a settlement gives the moderates additional incentives to suppress the extremists.

Again, I use the concept of Markov perfectness as an equilibrium concept, the extremists' and the government's choices thus do not depend on the history of the game but only on the current state of the game. The extremists choose an effort level to conduct terror while a lenient government may grant independence to an occupied territory.

Now consider the appropriate Bellman equations for the extremists. $V^E(x, y|s, e)$ denotes the continuation value for the extremists, that is the discounted expected net present value of their payoffs. Like for the moderates this continuation value depends respectively on the two state variables, the type of government and the status of the territory, and on the two action variables, the moderates' decision to suppress terror and the effort level chosen by the extremists.

$$\begin{aligned} V^E(l, oc|\sigma^M, \sigma^E) = & \\ u^E(oc) - ec + & \quad \delta \Big[Pr[\tau_l|\sigma^M, \sigma^E] V^E(l, in|\sigma^M, \sigma^E) + \\ & \quad (1 - Pr[\tau_l|\sigma^M, \sigma^E]) V^E(r, oc|\sigma^M, \sigma^E) \Big] \end{aligned} \tag{6.9}$$

and

$$\begin{aligned} V^E(r, oc|\sigma^M, \sigma^E) = & \\ u^E(oc) - ec + & \quad \delta \Big[Pr[\tau_l|\sigma^M, \sigma^E] V^E(r, oc|\sigma^M, \sigma^E) + \\ & \quad (1 - Pr[\tau_l|\sigma^M, \sigma^E]) V^E(l, oc|\sigma^M, \sigma^E) \Big] \end{aligned} \tag{6.10}$$

where $e = \underline{e}$ if σ^E implies that the extremists choose a low effort level and $e = \overline{e}$ if σ^E implies that the extremists choose a high effort level.

Choosing a high effort level to conduct terror is more costly for the extremists than choosing a low effort level. The extremists therefore choose a low effort level once independence is granted to the territory. When the territory is still occupied, the payoff also depends on whether there is a lenient government in power since a lenient government

may grant independence while a non-lenient government will not. The next Proposition summarizes the extremists' actions in a pure strategy Markov equilibrium of the game. For expressions that implicitly give the cutoff values in the Proposition, see the derivations in the Appendix of this chapter.

Proposition 6.4.1. *There exist cutoff values $c^* > 0$ and $c^{**} < 0$ such that: (i) When $x = l$ and $y = oc$, the extremists will choose a high effort level if $c < c^*$; (ii) When $x = r$ and $y = oc$, the extremists will choose a high effort level if $c < c^{**}$; (iii) When $y = in$, the extremists will choose a low effort level.*

From Proposition 6.4.1 it follows that the decision the extremists face depends on the type of the government when the territory is still occupied. When a lenient government is in power, the extremists have an incentive to choose a high effort level to conduct terror to decrease the probability of getting independence while when a non-lenient government is in power, the extremists choose a low effort to reduce the possibility that this government is replaced by a lenient one and hence to reduce the chance of getting independence. In the case with the lenient government, part (i) of the Proposition implies that the costs of choosing a high effort level should not be too high, while the choice for a high effort level becomes more likely when the effect of choosing a high effort level is higher or when the degree extremists dislikes the chance of getting independence is higher. In the case with a non-lenient government, part (ii) implies that extremists will only choose a high effort level when, independent from potential consequences, a high effort level is *beneficial* for extremists. The choice for a high effort level becomes less likely when the extremists care more about the future, when the effect of choosing a high effort level is higher or when the advantage (from the extremists' point of view) of having a non-lenient government is larger.

6.5 Extremism

In Section 6.4 I assumed that the radical extremists prefer a continuation of the occupation over a compromise. This is the maximum of extremism one can observe, where the extremists are extreme in their objective, which is an unacceptable one for the public, and extreme in their method, namely violence. It is possible, however, that extremists are extreme in the methods used, but that their claims, although disliked, are not unacceptable for the public. This section looks at the incentives of such extremists. The payoffs of the extremists, $u^E(y, e)$, again depends on the status of the territory ($y = oc, in$) and the effort level chosen by the extremists ($e = \underline{e}, \overline{e}$). The only change in the model presented in Section 6.4 is that inequality sign in Expression (6.7) changes into the following.

$$u^E(in, e_1) > u^E(oc, e_2) \quad e_1, e_2 \in \{\underline{e}, \overline{e}\} \tag{6.11}$$

Expression (6.11) implies that the extremists are better of when independence is granted. In the analysis of this section, the strategy of the moderates is again similar to the one found in Section 6.3, thus $0 < b < b^{**}$ and the moderates suppress terror when the disputed territory got its independence or when there is a lenient government.

Now consider the appropriate Bellman equations for the extremists. $V^E(x, y|s, e)$ denotes the continuation value for the extremists, that is the discounted expected net present value of their payoffs. Like for the moderates this continuation value depends respectively on the two state variables, the type of government and the status of the territory, and on the two action variables, the moderates' decision to suppress terror and the effort level chosen by the extremists.

$$\begin{aligned} V^E(l, oc|\sigma^M, \sigma^E) = \\ u^E(oc) - ec + \quad & \delta \Big[Pr[\tau_l|\sigma^M, \sigma^E] V^E(l, in|\sigma^M, \sigma^E) + \\ & (1 - Pr[\tau_l|\sigma^M, \sigma^E]) V^E(r, oc|\sigma^M, \sigma^E) \Big] \end{aligned} \tag{6.12}$$

and

$$\begin{aligned} V^E(r, oc|\sigma^M, \sigma^E) = \\ u^E(oc) - ec + \quad & \delta \Big[Pr[\tau_l|\sigma^M, \sigma^E] V^E(r, oc|\sigma^M, \sigma^E) + \\ & (1 - Pr[\tau_l|\sigma^M, \sigma^E]) V^E(l, oc|\sigma^M, \sigma^E) \Big] \end{aligned} \tag{6.13}$$

where $e = \underline{e}$ if σ^E implies that the extremists choose a low effort level and $e = \overline{e}$ if σ^E implies that the extremists choose a high effort level.

Choosing a high effort level to conduct terror is more costly for the extremists than choosing a low effort level. Like radical extremist, the extremists therefore choose a low effort level once independence is granted to the territory. When the territory is still occupied, the payoff also depends on whether there is a lenient government in power since a lenient government may grant independence while a non-lenient government will not. The next Proposition summarizes the extremists' actions in a pure strategy Markov equilibrium of the game. For expressions that implicitly give the cutoff values in the Proposition, see the derivations in the Appendix of this chapter.

Proposition 6.5.1. *There exist cutoff values $c^* < 0$ and $c^{**} > 0$ such that: (i) When $x = l$ and $y = oc$, the extremists will choose a low effort level if $c > c^*$; (ii) When $x = r$ and $y = oc$, the extremists will choose a low effort level if $c > c^{**}$; (iii) When $y = in$, the extremists will choose a low effort level.*

The proof of this Proposition can be derived with straightforward adjustments of the proof of Proposition 6.4.1. From Proposition 6.5.1 it follows that the decision the extremists face depends on the type of government when the territory is still occupied. When a lenient government is in power, extremists have an incentive to choose a low effort level to increase the probability of getting independence while when a non-lenient government is in power, the extremists have an incentive to choose a high effort level to increase the probability that this government is replaced by a lenient one. In the case with a lenient government, part (i) of the Proposition implies that even when choosing a low effort level is more costly than choosing a high effort level, the extremists might choose a low effort level. The choice for this low effort level becomes more likely when the effect of choosing a high effort level is higher or when the extremists have a stronger preference for independence. In the case with a non-lenient government, part (ii) implies that the

extremists will only choose a low effort level when choosing a high effort level is too costly, while choosing a high effort level becomes less likely when the extremists care more about the future, when the degree of successfulness of choosing a high effort level is higher or when the improvement of having a lenient government is larger.

6.6 Autonomy versus independence

Instead of the choice between just occupation and independence, a compromise of first granting autonomy to the disputed territory may be possible. The disputed territory then gets the freedom to make decision on certain areas, but on other areas it is subject to the decisions taken by the government. This was the idea behind the Oslo agreements between Israelis and Palestinians, specifying that certain parts of the land came under complete Palestinian control, over other parts the Palestinians would get control over civil matters and some part would remain under Israeli control, although there would be a gradual transfer of control to the Palestinians.

In the cases where the government is trying to reach an agreement with individuals in a territory where some of the individuals belong to a movement which is conducting terror there is often a lot of mistrust in the intentions of the other group. In this section I look at a possibility for how this mistrust can be circumvented.

In the previous sections a lenient government could grant independence to the occupied territory. A potential problem with this is that this can be seen as a bridge too far and that initially only an agreement can be reached on the allotment of autonomy. In contrast with the status of independence studied in the previous sections, I assume that autonomy is not permanent in the sense that it can be withdrawn and that once autonomy is granted, a next step can be the allotment of independence. In this section, the sixth step of the game, described in Section 6.2, is changed. I now assume that under certain conditions, a non-lenient (right-wing) government will reoccupy an autonomous territory, while under other sets of conditions, a lenient (left-wing) government will grant autonomy to an occupied territory or independence to an autonomous territory. Again, independence is an absorbing state, once the territory becomes independent, its status cannot be changed.

Not only the timing of the game changes, but also the rule specifying the actions of the government. A lenient government will now grant autonomy (au) to an occupied territory or independence (in) to an autonomous territory if the realized level of terror (τ) is low ($\tau = \tau_l$). A non-lenient government reoccupies an autonomous region if the realized level of terror is high ($\tau = \tau_h$).

The payoffs of the public depend on the status of the territory ($y = in, au, oc$) and on the perceived level of terror $\tau = \tau_l, \tau_h$. Again, individuals in the public prefer a low level of terror over a high level. Individuals in the public prefer occupation over granting autonomy to the disputed territory and autonomy over granting independence, for a given level of terror. Reasons mentioned in Section 6.2 are the control over natural resources or the fear of further political disintegration. The individuals are following the same retrospective voting rule specified in the description of the general model.

In the remaining of this section, I first discuss the moderates' strategy, then the effect the intermediate status of autonomy has on the strategy of the radical extremists and finally I discuss the strategy of the extremists.

6.6.1 Moderates

The payoffs of the moderates, $u^M(.)$, depend on the status of the disputed area $y = in, au, oc$ and on the decision to suppress terror s. The assumptions in (6.2) and (6.3) change into the following, to take into account the possibility that the disputed territory gets the status of autonomy.

$$u^M(in, s) > u^M(au, s) > u^M(oc, s) \quad s = 0, 1 \tag{6.14}$$

$$u^M(y, s) = u^M(y) + sb \quad y = in, au, oc; s = 0, 1 \tag{6.15}$$

where $b > 0$ again denotes the benefits for the moderates of suppressing terror. Inequalities (6.14) imply that the moderates prefer independence over autonomy and autonomy over independence, while inequality (6.15) implies that it is indeed beneficial for the moderates to suppress terror.

When we look at expression (6.15) we see that since $b > 0$ not suppressing is costly and the moderates will therefore always suppress terror once independence is granted. Apart from the decision to suppress terror, the payoffs of the moderates also depends on the status of the disputed territory. When the territory is still occupied the moderates have a greater incentive to suppress terror when a lenient government is in power since a lenient government may grant autonomy. When autonomy is granted, the moderates have an incentive to suppress terror if a lenient government is in power to increase the probability of getting independence. The next Proposition formalizes the moderates' actions in a pure strategy Markov equilibrium of the game.

Proposition 6.6.1. *There exist cutoff values $b^* < 0$, $b^{**} > 0$, $b^{***} < 0$ and b^{****} such that the moderates will suppress terror if: (i) $x = l$, $y = oc$ and $b > b^*$; (ii) $x = r$, $y = oc$ and $b > b^{**}$; (iii) $x = l$, $y = au$ and $b > b^{***}$; (iv) $x = r$, $y = au$ and $b > b^{****}$ and (v) $y = in$.*

The interpretation of the results in (i), (ii), (iii) and (v) are similar to the results found in Proposition 6.3.1. The moderates suppress terror when there is a lenient government, when there is a non-lenient government and not suppressing terror is too costly and when the status of the disputed territory is independence. Part (iv) of the Proposition shows the dilemma for the moderates when the territory is autonomous but not independent under a non-lenient government. Suppressing terror makes a continuation of autonomy more likely while not suppressing terror is costly. Moreover, not suppression makes reoccupation more likely. The intermediate step of autonomy may thus have two effects on reaching a definite agreement on independence: firstly, it takes one period more to reach such an agreement and secondly the probability of reaching such an agreement is smaller.

6.6.2 Radical extremism

Radical extremists reject any compromise with the government, whether on autonomy or on independence. When the government keeps the right to grant the autonomous region

independence, the extremists therefore face a similar decision as discussed in Section 6.4. More interesting is the case when the government also gives the region the right to change the status of autonomy.

The extremists thus reject any compromise with the government. When it is credible that the moderates in the disputed territory have the right to change the status of the territory, the extremists will face a similar decision as discussed in Section 6.4. The violence, however, will now be directed to the moderates, who have the possibility to give up autonomy. Granting autonomy or independence thus only shifts the burden of violence from the public to the moderates when the moderates have the right to decide on the status of the territory.

6.6.3 Extremism

The payoffs of the extremists, $u^E(y, e)$, depend on the status of the territory ($y = oc, au, in$) and the effort level the extremists choose $e = \underline{e}, \overline{e}$. The assumptions given in 6.11 now changes into the following, to take into account the possibility that the disputed territory gets the status of autonomy.

$$u^E(in, e_1) > u^E(au, e_2) > u^E(oc, e_3) \quad e_1, e_2, e_3 \in \{\underline{e}, \overline{e}\} \tag{6.16}$$

These inequalities imply that the extremists prefer independence over status of autonomy and autonomy over occupation. Throughout this subsection, the choices of the moderates are the choices described in Section 6.3, which implies that $0 < b < \min\{b^{**}, b^{****}\}$.

The incentives of the extremists are characterized in the following Proposition.

Proposition 6.6.2. *There exist cutoff values $c^* < 0$, $c^{**} > 0$, $c^{***} < 0$ and $c^{****} > 0$ such that extremists will choose a low effort level when: (i) $x = l$, $y = oc$ and $c > c^*$; (ii) $x = r$, $y = oc$ and $c > c^{**}$; (iii) $x = l$, $y = au$ and $c > c^{***}$; (iv) $x = r$, $y = au$ and $c > c^{****}$; (v) $y = in$.*

The interpretation of the results in (i), (ii), (iii) and (v) are similar to the results found in Proposition 6.5.1. The extremists choose a low effort level when there is a lenient government, when there is a non-lenient government and choosing a high effort level is too costly and when the status of the territory is independence. Part (iv) of the Proposition shows the dilemma the extremists face when the territory is autonomous under a non-lenient government. Choosing a low effort level makes a continuation of autonomy more likely while choosing a high effort level makes a reoccupation more likely and the extremists prefer autonomy over occupation. After the reoccupation, however, the public elects a lenient government, and that makes it possible that the territory first gets autonomy and then gets independence and the extremists prefer independence over autonomy. Reoccupation can thus potentially make extremists better off. The intermediate step of autonomy may thus have two effects on reaching a definite agreement on independence: firstly, it takes one period more to reach such an agreement and secondly the probability of reaching such an agreement is smaller.

When the moderates get the right to change status of the territory, the trade offs specified in points (i) and (ii) of Proposition 6.6.2 do not change qualitatively. Once

autonomy is granted, however, the extremists do not have an incentive to conduct terror aimed at the public, since the moderates now have the rights to decide on the status of the territory. The incentives to conduct terror aimed at the decision makers, the moderates in this case, are however smaller since it is aimed at a group of individuals the extremists are closely related to. Independent of whether the moderates do have the right to change the status of the territory, the incentives are also reduced since autonomy is preferred over occupation. The effect terror might have also depends on the payoffs of the moderates, it need not be the case that the moderates will choose for independence once they are the target of extremism. From the above, it thus follows that the occurrence of terror is less likely when the moderates have the right to decide on the status of the territory.

6.7 Concluding remarks

This chapter studies the incentives to suppress and to conduct terror. In the model, there is a disputed territory and there are four groups of players, the public, the government, the moderates and the extremists. In the equilibria of the model used, the moderates have larger incentives to suppress terror when there is a lenient government or when the territory became independent. In the chapter I argue that there are two kinds of extremism, one where extremists are not willing and one where extremists are willing to compromise. In the former case of radical extremism, the extremists have more incentives to conduct terror when there is a bigger chance on an agreement between the government and the moderates, while in the latter case the extremists have a larger incentive to conduct terror when this probability is small.

The model has some implications for policymakers who are striving for peace settlements. When the terrorists involved are also extreme in their objectives, which is as I have argued the case for Hamas in the Israeli/Palestinian conflict, then a rapid implementation of a durable agreement is especially important since in these cases terrorists have strong incentives to conduct terror to interrupt the peace process. Working out first an agreement like done with the Geneva Accord in 2003 could facilitate such a rapid implementation.

A second implication is that with extremists who are not extreme in their objectives, like the ETA in Basque Country and the IRA in Northern Ireland, it is less problematic to have a peace process where the disputed territory first gets autonomy and probably later independence. Moreover, when the right to decide on the status of the territory is given to the population in the territory, the incentives of extremists to conduct terror are decreased significantly, although they may now target the population in the territory. This right was given to the people of Northern Ireland in 1998, when a referendum on its status was organized, but something similar has not been organized in Basque Country. This might be an explanation for the fact that IRA violence directed at the rest of the United Kingdom has diminished while ETA violence directed at the rest of Spain has not.

Finally, I will give some suggestions for further research. A first one is on the additional empirical research. Although Berrebi and Klor (2004) and Kydd and Walter (2002) already present some evidence, testing the hypothesis that Hamas is more active when

the chance on a settlement is higher deserves a more systematic attempt. In addition, one can look at how active for example the ETA or the IRA are, to test if there is any relation with the chance on a peaceful settlement.

Another possibility is introducing another party in the model. Goldstein et al. (2001) for example show that there are significant responses to actions of the United States of America in the conflict between Israelis and Palestinians. An outsider might change the equilibria of the game, for example by influencing the payoffs of the players in the model or by imposing a solution on the parties.

6.8 Appendix

Proof of Proposition 6.3.1: When $x = l$ and $y = oc$, the moderates will suppress terror if their expected payoff when not suppressing is less than the expected terror when suppressing. Using the appropriate Bellman equations and part (iii) of the Proposition, this can be written as follows.

$$\begin{aligned} &u^M(oc) + \delta \left[\alpha_1 V^M(l, in|1, \overline{e}) + \max_{s \in \{0,1\}} (1 - \alpha_1) V^M(r, oc|s, \overline{e}) \right] < \\ &u^M(oc) + b + \delta \left[\alpha_2 V^M(l, in|1, \overline{e}) + \max_{s \in \{0,1\}} (1 - \alpha_2) V^M(r, oc|s, \overline{e}) \right] \end{aligned} \tag{6.17}$$

Rearranging the terms of inequality (6.17) gives the following.

$$b > -\delta (\alpha_2 - \alpha_1) \left[V^M(l, in|1, \overline{e}) - \max_{s \in \{0,1\}} V^M(r, oc|s, \overline{e}) \right] \tag{6.18}$$

By assumption, $V^M(l, in|1, \overline{e}) > \max_{s \in \{0,1\}} V^M(r, oc|s, \overline{e})$, $\alpha_2 > \alpha_1$ and $\delta > 0$ and the right hand side of inequality (6.18) is therefore smaller than 0, which implies that this condition is always satisfied. Expression (6.18) thus implicitly defines a cutoff value $b^* < 0$ for b.

When $x = r$ and $y = oc$ the moderates will not deviate from the strategy of not suppressing terror if their expected payoff is larger than the expected payoff when suppressing terror. Using the appropriate Bellman equations, one can write this as follows.

$$\begin{aligned} &u^M(oc) + \delta \left[\alpha_1 V^M(r, oc|1, \overline{e}) + (1 - \alpha_1) \max_{s \in \{0,1\}} V^M(l, oc|s, \overline{e}) \right] > \\ &u^M(oc) + b + \delta \left[\alpha_2 V_M(r, oc|1, \overline{e}) + (1 - \alpha_2) \max_{s \in \{0,1\}} V^M(l, oc|s, \overline{e}) \right] \end{aligned} \tag{6.19}$$

From the discussion following on inequality (6.18) in the first part of the proof, we know that $\max_{s \in \{0,1\}} V^M(l, oc|s, \overline{e}) = V^M(l, oc|1, \overline{e})$ and inequality (6.19) can thus be rewritten as follows.

$$b > \delta (\alpha_2 - \alpha_1) \left[V^M(l, oc|1, \overline{e}) - V^M(r, oc|1, \overline{e}) \right] \tag{6.20}$$

By assumption, $V^M(l, oc|1, \overline{e}) > V^M(r, oc|1, \overline{e})$, $\alpha_2 > \alpha_1$ and $\delta > 0$ and the right hand side of inequality (6.20) is therefore greater than 0. Expression (6.20) thus implicitly defines a cutoff value $b^{**} > 0$ for b.

For the last part of the Proposition, first note that the continuation value for the moderates once independence is granted $V^M(x, in|k, \overline{e})$ can be written as follows.

$$V^M(x, in|s, \overline{e}) = \max_{s\in\{0,1\}} \frac{u^M(in) + sb}{1-\delta} \tag{6.21}$$

Since $b > 0$ the optimal choice is $s = 1$, hence the moderates will suppress terror once independence is granted.

Finally, note that when the extremists choose a high effort level $\overline{e}$, α_2 will be replaced by α_3 and α_1 by α_2. Since $\alpha_3 > \alpha_2$, the results change only quantitatively. □

Proof of Proposition 6.4.1: When $x = l$ and $y = oc$, the extremists will choose a high effort level if their expected payoff $V^E(l, in|\sigma^M, \overline{e})$ is larger than the expected payoff when choosing a low effort level $V^E(l, in|\sigma^M, \underline{e})$. Using the appropriate Bellman equations, Proposition 6.3.1 and part (iii) of the Proposition, this can be rewritten as follows.

$$\begin{aligned} u^E(oc) - \overline{e}c + \delta\left[\alpha_2 V^E(l, in|1, \underline{e}) + (1-\alpha_2)\max_{e\in\{\underline{e},\overline{e}\}} V^E(r, oc|0, e)\right] > \\ u^E(oc) - \underline{e}c + \delta\left[\alpha_3 V^E(l, in|1, \underline{e}) + (1-\alpha_3)\max_{e\in\{\underline{e},\overline{e}\}} V^E(r, oc|0, e)\right] \end{aligned} \tag{6.22}$$

From the discussion following on inequality (6.25) in the second part of the proof it follows that $\max_{e\in\{\underline{e},\overline{e}\}} V^E(r, oc|0, e) = V^E(r, oc|0, \underline{e})$ and inequality (6.22) can thus be rewritten as follows.

$$(\overline{e} - \underline{e})\, c < \delta\,(\alpha_3 - \alpha_2)\left[V^E(r, oc|0, \underline{e}) - V^E(l, in|1, \underline{e})\right] \tag{6.23}$$

By assumption, $V^E(r, oc|0, \underline{e}) - V^E(l, in|1, \underline{e})$, $\alpha_3 - \alpha_2 > 0$ and $\delta > 0$ and the right hand side of inequality (6.23) is therefore larger than 0. Expression (6.23) thus implicitly defines a cutoff value $c^* > 0$ for c.

When $x = r$ and $y = oc$, the extremists will not deviate from the strategy of choosing a low effort level if their expected payoff is larger than the expected payoff when choosing a high effort level, that is, when $V^E(r, oc|\sigma^M, \underline{e}) > V^E(r, oc|\sigma^M, \overline{e})$. Using the appropriate Bellman equations, one can write this as follows.

$$\begin{aligned} u^E(oc) - \underline{e}c + \delta\left[\alpha_2 V^E(r, oc|0, \underline{e}) + (1-\alpha_2)\max_{e\in\{\underline{e},\overline{e}\}} V^E(l, oc|1, e)\right] > \\ u^E(oc) - \overline{e}c + \delta\left[\alpha_1 V^E(r, oc|0, \underline{e}) + (1-\alpha_1)\max_{e\in\{\underline{e},\overline{e}\}} V^E(l, oc|1, e)\right] \end{aligned} \tag{6.24}$$

Inequality (6.24) can be rewritten as follows.

$$(\overline{e} - \underline{e})\, c > -\delta\,(\alpha_2 - \alpha_1)\left[V^E(r, oc|0, \underline{e}) - \max_{e\in\{\underline{e},\overline{e}\}} V^E(l, oc|1, e)\right] \tag{6.25}$$

When $V^E(r, oc|0, \underline{e}) > \max_{e\in\{\underline{e},\overline{e}\}} V^E(l, oc|1, e)$, the right-hand side of inequality (6.25) is negative and the condition is always satisfied, that is, when $V^E(r, oc|0, \underline{e}) > V^E(l, oc|1, \underline{e})$ and $V^E(r, oc|0, \underline{e}) > V^E(l, oc|1, \overline{e})$.

Using the appropriate Bellman equations, $V^E(r, oc|0, \underline{e}) > V^E(l, oc|1, \underline{e})$ can be written as follows.

$$\begin{array}{c} u^E(oc, \underline{e}) + \delta \left[\alpha_2 V^E(r, oc|0, \underline{e}) + (1-\alpha_2) V^E(l, oc|1, \underline{e})\right] > \\ u^E(oc, \underline{e}) + \delta \left[\alpha_3 V^E(l, in|1, \underline{e}) + (1-\alpha_3) V^E(r, oc|0, \underline{e})\right] \end{array} \tag{6.26}$$

Since $V^E(l, oc|1, \underline{e}) < V^E(x, oc|\sigma^M, \underline{e})$ for $x \in \{l, r\}$, this inequality is satisfied.
Using the appropriate Bellman equations, $V^E(r, oc|0, \underline{e}) > V^E(l, oc|1, \overline{e})$ can be written as

$$\begin{array}{c} u^E(oc) - \underline{e}c + \delta \left[\alpha_2 V^E(r, oc|0, \underline{e}) + (1-\alpha_2) V^E(l, oc|1, \overline{e})\right] > \\ u^E(oc) - \overline{e}c + \delta \left[\alpha_2 V^E(l, in|1, \underline{e}) + (1-\alpha_2) V^E(r, oc|0, \underline{e})\right] \end{array} \tag{6.27}$$

Since $V^E(l, oc|1, \overline{e}) < V^E(x, oc|\sigma^M, \underline{e})$ for $x \in \{l, r\}$ and $V^E(l, in|1, \underline{e}) < V^E(l, oc|1, \overline{e})$, this inequality is satisfied.

For the last part of the Proposition, first note that the continuation value for the extremists once independence is granted $V^E(x, in, e)$ can be written as follows.

$$V^e(x, in|\sigma^M, e) = \max_{e \in \{\underline{e}, \overline{e}\}} \frac{u^E(in) - ec}{1-\delta} \tag{6.28}$$

Since $c > 0$ the optimal choice is $e = \underline{e}$, hence the the extremists will choose a low effort level to conduct terror once independence is granted. □

Proof of Proposition 6.6.1: The proof of parts (i), (ii), (iii) and (v) can be derived with straightforward adjustments of the proofs of Proposition 6.3.1. For part (iv), note that when $x = r$ and $y = au$ the moderates will not deviate from their strategy of suppressing terror if their expected payoff is larger than the expected payoff when not suppressing terror. Using the appropriate Bellman equations and part (i), one can rewrite this as follows.

$$\begin{array}{c} u^M(au) + b + \delta \left[\alpha_2 V^M(r, au|1, \overline{e}) + (1-\alpha_2) V^M(l, oc|1, \overline{e})\right] > \\ u^M(au) + \delta \left[\alpha_1 V_M(r, au|1, \overline{e}) + (1-\alpha_1) V^M(l, oc|1, \overline{e})\right] \end{array} \tag{6.29}$$

Rearranging the terms of inequality (6.29) gives the following.

$$b > \delta (\alpha_2 - \alpha_1) \left[V^M(l, oc|1, \overline{e}) - V^M(r, au|1, \overline{e})\right] \tag{6.30}$$

Expression (6.20) implicitly defines a cutoff value b^{****} for b. □

Chapter 7

Summary and further research

The disintegration of the former Soviet Union and the former Socialist Republic of Yugoslavia in the last ten years of the 20th century has received much attention. Apart from this, referenda on secession have been held in Northern Ireland in the United Kingdom, Quebec in Canada and East Timor in Indonesia. On the contrary, there has been a move towards greater integration in Europe since the Second World War, there was the German reunification and the unification of Yemen, both in 1990. These major events and developments have also attracted the attention of economists, and right now a considerable amount of research is been performed, Bolton, Roland and Spolaore (1996) and Alesina (2003) have conducted surveys of this research.

The incentives of individuals to form jurisdictions are central to the questions that are addressed in this thesis. Consecutively, the roles of public good provision, of intergovernmental transfers and of violence are discussed. A microeconomic approach to study this is used throughout this thesis.

Reviewing the literature from this perspective, several topics can be found that have not received sufficient attention. The chapters in this thesis discuss several of these topics. In Part I, consisting of Chapters 2, 3 and 4, individuals face a trade-off between on the one hand the benefits of country size for public good provision, and on the other hand the costs of country size in terms of influence on political decision making. In Part II, containing Chapter 5, a model of local public good provision is studied. In Part III, consisting of Chapter 6, a dynamic model is used to study the interplay of violence and secessionism.

Summary and conclusions

Part I contains models in which individuals face the following trade-off. The smaller a nation, the likelier it is that the public goods provided are of the type which is preferred by an individual, but also the costlier public good provision.

There are three chapters in Part I. The first one, Chapter 2, considers a two-region model where the boundary between the two is exogenously fixed. In many instances, boundaries between regions are more or less fixed, due to for example historical, cultural or geographical reasons. It starts with the question how the difference in size between the two regions affects the regional incentives for unification.

Unification allows regions to exploit economies of scale, but separation allows for greater influence over the nature of political decision making. When the preferences over the type of public goods to be provided are distributed uniformly, the small region has greater incentives for unification than the large region. The more these preferences are clustered in the large region, however, the larger the incentives for unification are in the large region and the smaller the incentives for unification are in the small region.

The individuals located near the boundary between the two regions have the largest incentives for unification. For them, the loss in influence on decision making is smallest, they might even gain influence due to unification. This follows from the fact that after unification often a compromise on public good provision is reached that does not differ much from the preferences of these individuals. Likewise, when there are three regions, the individuals in the region that is located between the other two regions have the largest incentives for unification. Only when the economies of scale in public good provision are relatively small, these individuals may prefer either independence or unification with only one of the two other regions.

From a social welfare point of view, majority voting leads to excessive incentives for separation. These excessive incentives can be mitigated by implementing alternative voting systems. These systems can for example differ in the specification of what happens when the votes on unification in the two regions yield two different outcomes. From a social welfare point of view, unification is preferred over separation in case there are two different outcomes in the votes in both regions. Moreover, when the two voting outcomes are different, unification is also preferred by a majority of the individuals in both regions together.

The analysis presented in Chapter 3 is close to the analysis in Chapter 2. Again, a model with two regions is studied, in which individuals can choose for unification to exploit economies of scale, at the cost of losing influence on political decision making. After unification individuals now have additional possibilities for public good provision. A motivation for this approach is the observation that the types of public goods provided under separation can also be provided in a union of the two regions in which both regions cooperate. Like in Chapter 2, the large region has smaller incentives to unite or to cooperate than the small region. The incentives for separation turn out to be motivated both by the wish to have a type of public good close to the most preferred type as well as by the wish to provide more public goods. The former is an incentive for separation while the latter is an incentive for public good provision. From a social welfare point of view, there are not only excessive incentives for separation, but also excessive incentives for public good provision.

In Chapter 4 it is still the case that individuals in smaller countries have greater influence over the nature of political decision making. In larger countries, however, the total amount of public goods provided is larger while the per capita costs of public good provision are lower. This approach to the amounts and costs is motivated and supported by empirical findings. Also in this model individuals have excessive incentives for separation and individuals located on the border of a country do not take into account the effect separation has on the other individuals in the country.

In the twentieth century, not only the number of countries increased significantly, also public spending increased considerably, not only in absolute terms but also in relation

to gross domestic product. The outcomes of the model are consistent with these two developments. Finally, it is argued in Chapter 4 that countries with a parliamentary democracy are expected to be smaller than countries with a presidential-congressional system.

Thus, one main conclusion can be drawn from the chapters in Part I: majority voting on unification typically leads to excessive separation, from a social welfare point of view. Chapter 2 argues that this applies to several majority voting rules and to the case where preferences are not uniformly distributed, while Chapter 3 shows that this also holds when individuals have the possibility of forming a union with additional possibilities for public good provision. In Chapter 4, it is argued that pending on the rights to secede the individuals have, countries need not be too small from a social welfare point of view, and it is noticed that the right to secede is often limited.

Part II contains Chapter 5. This chapter studies a model of local public good provision in a country consisting of a large number of heterogeneous regions. Each region consists of two districts, a large one called the city and a small one called the village, and the public goods provided in a district have positive spillover effects on the neighboring district. When the two districts are autonomous, the amounts of public goods provided under majority voting are lower than the amounts which are optimal from a social welfare point of view. Under majority voting, the positive spillover effects of the local public goods are not taken into account.

The districts can choose to remain autonomous or to unite. Since the individuals from the largest district form the majority in a region, they dominate the political decision making after unification and therefore the individuals in the largest district always prefer unification over autonomy. As a rule, however, from a social welfare point of view the individuals in the smallest district have insufficient incentives for unification. For them, the costs of unification are not only the loss of influence on decision making, but also the taxes revenues from the individuals in the small regions which are used to finance public good provision in the large region. For the individuals in the small region the advantages of unification outweigh the disadvantages only when the spillover effects are large enough.

The majority voting outcomes on unification and public good provision thus deviate from the optimal outcome from a social welfare point of view. The chapter discusses how intergovernmental transfers can mitigate the deviations of the majority voting outcome from the socially optimal outcome. Such a system of intergovernmental transfers exists in many countries, for example in Germany, in the United States and in the Netherlands. The transfer scheme studied consists of earmarked transfers and of lump-sum transfers. It turns out that the earmarked transfers act only upon the amounts of local public goods provided while the lump-sum transfers act only upon the decision on unification. The optimal level for both transfers depend on the the size of the spillover effects in each region. The transfers can alleviate the deviation from the social optimum, but unless the government is fully informed about local preferences the optimal outcome from a social welfare point of view cannot be reached.

Part III consists of Chapter 6 and studies the interplay of violence and secessionism. This analysis is motivated by the observation that in several cases, like in the Israeli/Palestinian or the Spain/Basque country conflicts, secessionism goes together with violence. The

chapter uses a dynamic model to discuss the incentives of moderates and terrorists, both agitating for independence. The terrorists are willing to use violence to reach their goals. It is argued that there are two types of terrorists, those who are willing to compromise on a form of independence, and those who are not. The use of violence is costly for the terrorists, and the moderates can choose to suppress the use of violence. When the probability of obtaining independence is higher, the moderates have a larger incentive to suppress the use of violence and the terrorists who are willing to compromise have smaller incentives to conduct terror when the probability of reaching an agreement is higher. The terrorists who are not willing to compromise, however, have larger incentives to conduct terror when the probability of reaching an agreement is higher to prevent that a compromise on independence is reached.

Issues for further research

Regarding the subjects of research in this thesis, several interesting extensions and important topics remain to be studied.

In connection to the Chapters in Part I, one hypothesis for empirical work is that countries with a presidential-congressional system are expected to be larger than the countries with parliamentary democracy. A second hypothesis is that an increase in public spending has a negative impact on country size. More theoretical extensions of the work are also possible. Firstly, the public good is assumed to be indivisible. Some decentralization, however, is possible in public good provision. Secondly, one can introduce congestion effects in public goods. Thirdly, the approach used in existing work often uses static models. The size of many countries, however, changes over time and a dynamic approach might give insights into these changes. Connected to this, the formation of countries and the change of borders are often assumed to be frictionless, while in reality this can be a costly process. It is therefore worth studying models with more realistic rules for the formation of countries and for border changes.

Several extensions of the analysis presented in Part II of this thesis are possible. Firstly, in reality individuals are mobile and where they settle is determined by for example how costly mobility is and what the housing prices are. These factors can be introduced in the model to add an important factor in local decision making. Secondly, it is possible that two initially independent jurisdictions first bargain over an agreement specifying the relationship between the two after unification, before deciding on unification. Special attention then has to be paid to the enforcement of these agreements after unification. Thirdly, when a transfer scheme is designed, maximizing social welfare does not need to be the only objective. In reality, lobbying efforts and electoral considerations also play a role. Fourthly, introducing income heterogeneity among individuals would bring the approach closer to reality, a suggestion which is also valid for the analysis presented in Part I of this thesis.

A suggestion for further research related to the topics presented in Part III of this thesis, is to study how the terrorist activity of groups like the ETA, IRA or Hamas is related

to the political situation in, respectively, Spain, the United Kingdom and Israel. A more theoretical extension would be to study the interplay of more than two players in a dynamic model. In reality, often more than just two players are involved in a conflict.

Samenvatting (Summary in Dutch)

Het uiteenvallen van de voormalige Sovjet-Unie en de voormalige Socialistische Republiek van Joegoslavië in de laatste tien jaar van de twintigste eeuw heeft veel aandacht getrokken. Daarnaast zijn er referenda over opdeling geweest in het Verenigde Koninkrijk, in het Canadese Quebec en in het Indonesische Oost Timor. In tegenstelling tot deze ontwikkelingen is er sinds de Tweede Wereldoorlog in Europa sprake van een steeds verder gaande samenwerking tussen verschillende landen en zijn beide delen van Duitsland en beide delen van Jemen in 1990 verenigd. Deze belangrijke gebeurtenissen hebben ook de aandacht getrokken van economen en tot nu toe is een aanzienlijke hoeveelheid onderzoek gedaan naar deze ontwikkelingen. Bolton, Roland en Spolaore (1996) en Alesina (2003) geven overzichten van dit onderzoek.

De prikkels van individuen om staatsrechtelijke eenheden te vormen staan centraal in de vragen die in dit proefschrift worden behandeld. Achtereenvolgens worden de rol van het aanbieden van publieke goederen, van overdrachten tussen overheden en van geweld besproken. In het gehele proefschrift wordt gebruik gemaakt van een micro-economische aanpak.

Als de al bestaande literatuur vanuit bovengenoemd perspectief bekeken wordt zijn er verschillende onderwerpen te vinden die onvoldoende aandacht hebben gekregen. De hoofdstukken in dit proefschrift behandelen een aantal van deze onderwerpen. In Deel I, bestaande uit de Hoofdstukken 2, 3 en 4, maken individuen de afweging tussen aan de ene kant de voordelen van de grootte van landen voor het aanbieden van publieke goederen, en aan de andere kant de nadelen van de grootte van landen, namelijk het verliezen van invloed op het maken van beslissingen. In Deel II, bestaande uit Hoofdstuk 5, wordt een model voor het aanbieden van lokale publieke goederen bestudeerd. In Deel III, bestaande uit Hoofdstuk 6, wordt een dynamisch model gebruikt om de rol van geweld van afscheidingsbewegingen te bestuderen.

Samenvatting en conclusies

Deel I bevat modellen waarin individuen de volgende afweging maken. Hoe kleiner het land waarin de individuen wonen, des te waarschijnlijk is het dat de aangeboden publieke goederen van het type zijn dat door een individu gewenst wordt, maar ook des te kostbaarder het aanbieden van publieke goederen.

Er zijn drie hoofdstukken in Deel I. In het eerste, Hoofdstuk 2, wordt een model gebruikt met daarin twee regio's, waarbij de grens tussen beide regio's exogeen is. In veel

gevallen liggen mogelijke grenzen namelijk min of meer vast, bijvoorbeeld om historische, culturele of geografische redenen. Het hoofdstuk start met de vraag hoe de verschillen in grootte van beide regio's de regionale prikkels tot eenwording beïnvloeden.

Eenwording maakt het voor de regio's mogelijk om gebruik te maken van schaalvoordelen in het aanbieden van publieke goederen, maar een afscheiding biedt grotere invloed op de te maken beslissingen. Als de voorkeuren voor het type van de aan te bieden publieke goederen uniform verdeeld zijn, heeft de kleine regio een sterkere prikkel tot eenwording dan de grote regio. Als de voorkeuren meer geconcentreerd zijn, heeft de grote regio daarentegen sterkere prikkels tot eenwording en de kleine regio zwakkere prikkels.

Individuen die zich dicht bij de grens tussen beide regio's bevinden hebben de sterkste prikkels tot eenwording. Voor hen is het verlies van invloed op het maken van beslissingen het kleinste, zij kunnen zelfs invloed winnen door eenwording. Dit komt doordat na eenwording er meestal een besluit over het publieke goed zal worden genomen dat niet veel verschilt van de voorkeur van deze individuen. In het geval dat er niet twee maar drie regio's zijn hebben de individuen in de regio die tussen de twee andere regio's ligt, net als bij bovengenoemde individuen, de grootste prikkels tot eenwording. Alleen als het aanbieden van publieke goederen relatief goedkoop is, zullen de individuen in de middelste regio ervoor kiezen voor afscheiding of voor het samengaan met slechts een van de andere twee regio's.

Vanuit het oogpunt van maatschappelijk welzijn leidt het nemen van beslissingen met een gewone meerderheid van stemmen tot excessieve prikkels tot afscheiding. Deze excessieve prikkels kunnen gematigd worden door het implementeren van alternatieve systemen om te stemmen. Deze systemen kunnen bijvoorbeeld verschillen in de specificatie van wat er gebeurd als de uitkomst van de stemmingen in beide regio's verschillende uitkomsten hebben. Vanuit het oogpunt van maatschappelijk welzijn heeft het systeem de voorkeur met in bovenstaande geval als uitkomst eenwording. Daarenboven heeft een meerderheid van de individuen in het geval dat de uitkomsten in beide regio's verschillen, de voorkeur voor eenwording.

Het onderzoek gepresenteerd in Hoofdstuk 3 hangt nauw samen met het onderzoek in Hoofdstuk 2. Opnieuw wordt er een model gebruikt met twee regio's waarin individuen kunnen kiezen voor eenwording om te profiteren van schaalvoordelen in het aanbieden van publieke goederen ten koste van invloed op de politieke besluitvorming. Individuen kunnen nu echter na eenwording er voor kiezen net zoveel types publieke goederen aan te bieden als na een afscheiding zou kunnen, wat niet mogelijk was in de analyse van Hoofdstuk 2. De motivatie van deze aanpak is dat de publieke goederen die na een afscheiding worden aangeboden in principe ook aangeboden kunnen worden als de beide regio's samenwerken in een unie. Net als in Hoofdstuk 2 heeft de grootste regio de zwakkere prikkels tot eenwording en tot samenwerken dan de kleine regio. De prikkels voor eenwording blijken voor te komen uit de wens publiek goederen te hebben die het meeste lijken op de gewenste publieke goederen en uit de wens meer publieke goederen aan te bieden. Het eerste wordt een prikkel tot afscheiding genoemd en het laatste een prikkel voor het aanbieden van publieke goederen. Vanuit het oogpunt van maatschappelijk welzijn zijn er niet alleen excessieve prikkels voor afscheiding, maar ook excessieve prikkels voor het aanbieden van publieke goederen.

In Hoofdstuk 4 is het nog steeds het geval dat individuen in kleinere landen een grotere invloed hebben op de politieke besluitvorming. In grotere landen is de totale hoeveelheid publieke goederen die wordt aangeboden echter groter terwijl de kosten per individu lager zijn, wat een belangrijk verschil is met de analyse in Hoofdstuk 2. Deze benadering van de hoeveelheden en kosten van het aanbieden van publieke goederen kan gemotiveerd worden met empirisch onderzoek. Ook in dit model hebben individuen excessieve prikkels tot afscheiding en houden individuen die zich bij de grenzen van een land bevinden geen rekening met de invloed die afscheiding heeft op andere individuen.

In de twintigste eeuw is niet alleen het aantal landen significant toegenomen, ook de toename in de publieke uitgaven is aanzienlijk toegenomen, niet alleen in absolute termen maar ook in relatie tot het bruto nationaal product. De uitkomsten van het model in Hoofdstuk 4 zijn consistent met beide ontwikkelingen. Ten slotte wordt in dit hoofdstuk beargumenteerd waarom landen met een parlementaire democratie naar verwachting kleiner zijn dan landen met een presidentieel-congressioneel systeem.

De voornaamste conclusie die gebaseerd kan worden op de hoofdstukken in Deel I van dit proefschrift is de volgende: kenmerkend voor besluitvorming met meerderheid van stemmen is dat er excessieve prikkels zijn tot afscheiding. Uit Hoofdstuk 2 blijkt dat dit geldt voor verschillende systemen van besluitvorming en voor het geval dat preferenties niet uniform verdeeld zijn terwijl Hoofdstuk 3 laat zien dat dit ook geldt voor het geval waarin individuen de mogelijkheid hebben om een unie te vormen waarin er extra mogelijkheden zijn tot het aanbieden van publieke goederen. In Hoofdstuk 4 wordt beargumenteerd dat afhankelijk van de rechten op afscheiding van individuen, landen niet noodzakelijkerwijs te klein zijn vanuit het oogpunt van maatschappelijk welzijn en dat daarnaast de rechten van individuen op afscheiding vaak beperkt zijn.

Deel II van dit proefschrift bestaat uit Hoofdstuk 5. Dit hoofdstuk bestudeert een model van het aanbieden van lokale publieke goederen in een land dat uit een groot aantal heterogene regio's bestaat. Elke regio bestaat uit twee districten, een grote die de stad wordt genoemd en een kleine die het dorp wordt genoemd. De publieke goederen die in een district worden aangeboden hebben een positieve invloed op het andere district in dezelfde regio. Als beide regio's autonoom zijn, zijn de hoeveelheden van de publieke goederen die worden aangeboden in beide regio's kleiner dan de hoeveelheden die optimaal zijn vanuit het oogpunt van maatschappelijk welzijn. Onder besluitvorming met meerderheid van stemmen houden individuen geen rekening met de positieve invloed van publieke goederen op het andere district.

Ieder district kan kiezen om autonoom te blijven of samen te gaan met het andere district. Aangezien de individuen in het grootste district de meerderheid vormen in de regio, domineren deze individuen het nemen van beslissingen na het samengaan beide districten. De individuen in het grootste district hebben derhalve altijd een voorkeur voor samengaan. In het algemeen hebben de individuen in het kleinste district vanuit het oogpunt van het maatschappelijk welzijn te weinig prikkels tot samengaan. Voor hen zijn de kosten van samengaan met het grootste district niet alleen het verlies van invloed op de te maken beslissingen, maar ook de belastingopbrengsten die de individuen in het grootste district zullen gebruiken voor het aanbieden van publieke goederen in het grootste district. Voor de individuen in het kleine district wegen de voordelen van het

samengaan alleen op tegen kosten als de positieve invloed die de publieke goederen in het ene district hebben op de individuen van het andere district groot genoeg is.

De uitkomsten als de beslissingen genomen worden met meerderheid van stemmen wijken dus af van de uitkomsten die optimaal zijn vanuit het oogpunt van maatschappelijk welzijn. Hoofdstuk 5 bediscussieert vervolgens hoe overdrachten tussen overheden de uitkomsten dichter bij de uitkomsten kan brengen die optimaal zijn vanuit het oogpunt van maatschappelijk welzijn. Een dergelijk systeem van overdrachten bestaat in bijvoorbeeld Duitsland, in de Verenigde Staten van Amerika en in Nederland. Het bestudeerde systeem bestaat uit geoormerkte overdrachten die alleen voor lokale publieke goederen gebruikt mogen worden en uit vaste bedragen. Het blijkt dat de geoormerkte overdrachten alleen de aangeboden hoeveelheden publieke goederen beïnvloeden terwijl de vaste bedragen alleen de prikkels om samen te gaan beïnvloeden. De overdrachten kunnen de uitkomsten dichter bij de uitkomsten brengen die optimaal zijn vanuit het oogpunt van maatschappelijk welzijn, maar tenzij de overheid volledig is geïnformeerd over lokale preferenties kan deze optimale uitkomst met overdrachten niet bereikt worden.

Deel III bestaat uit Hoofdstuk 6 en bestudeert de samenhang tussen geweld en afscheidingsbewegingen. Deze analyse wordt gemotiveerd met de observatie dat in verschillende gevallen, zoals in het Israëlisch-Palestijnse of het Spaans-Baskische conflict, afscheidingsbewegingen geweld kunnen gebruiken. Het hoofdstuk gebruikt een dynamisch model om de beweegredenen van gematigden en terroristen, die beide voor afscheiding zijn, te bespreken. De terroristen zijn bereid om geweld te gebruiken om afscheiding mogelijk te maken en in het hoofdstuk is beschreven dat er twee soorten van terroristen zijn, één die bereid is tot een compromis over een vorm van afscheiding en één die daartoe niet bereid is. Het gebruik maken van geweld is kostbaar voor de terroristen en de gematigden hebben de keuze om het gebruik van geweld door de terroristen te onderdrukken. Als de kans op afscheiding groter is, hebben de gematigden een sterkere prikkel om het gebruik van geweld tegen te gaan en hebben terroristen die tot een compromis bereid zijn een zwakkere prikkel om geweld te gebruiken. De terroristen die niet tot een compromis over een vorm van afscheiding bereid zijn hebben in dat geval echter een sterke prikkel om geweld te gebruiken om te voorkomen dat er een compromis wordt bereikt.

Verder onderzoek

Met betrekking tot de onderwerpen van onderzoek in dit proefschrift zijn er verschillende interessante en belangrijke punten die nog bestudeerd moeten worden.

In samenhang met de hoofdstukken in Deel I is er de hypothese voor empirisch onderzoek dat landen met een presidentieel-congressioneel systeem groter zijn dan landen met een parlementaire democratie. Een tweede hypothese is dat een toename in publieke uitgave een negatieve invloed heeft op de grootte van landen. Meer theoretische uitbreidingen van het onderzoek zijn ook mogelijk. Ten eerste wordt er aangenomen dat de aangeboden publieke goederen ondeelbaar zijn terwijl decentralisatie in het aanbieden van publieke goederen mogelijk is. Ten tweede kan er gekeken worden naar het effect van congestie op het aanbieden van publieke goederen. Ten derde zijn de gebruikte modellen statische modellen terwijl de grootte van landen over de tijd kan veranderen. Het gebruik van

dynamische modellen kan in deze veranderingen meer inzichten bieden. Hiermee samenhangend wordt er verondersteld dat het aanpassen van grenzen probleemloos verloopt, hoewel dit in werkelijkheid meestal een kostbaar proces is. Het is daarom de moeite waard om modellen te bestuderen met meer realistische aannames wat betreft de vorming van landen en het wijzigen van grenzen.

Verschillende uitbreidingen van de analyse in Deel II van dit proefschrift zijn mogelijk. Ten eerste zijn individuen in werkelijkheid mobiel en waar individuen zich vestigen wordt onder andere bepaald door hoe kostbaar mobiliteit is en wat de prijs van huisvesting is. Deze factoren kunnen geïntroduceerd worden in het model om zo een belangrijke factor in lokale besluitvorming toe te voegen. Ten tweede is het mogelijk dat twee aanvankelijk autonome districten eerst onderhandelen over een overeenkomst waarin wordt vastgelegd wat de relatie tussen de beide regio's wordt na samengaan. De beslissing over samengaan wordt dan pas genomen nadat een dergelijke overeenkomst is bereikt. Speciale aandacht moet dan wel besteed worden aan de uitvoering van dergelijke overeenkomsten. Ten derde is bij het ontwerpen van een systeem van overdrachten het maatschappelijk welzijn niet noodzakelijkerwijs de enige doelstelling. In werkelijkheid hebben lobbyactiviteiten en electorale overwegingen ook invloed op een dergelijk ontwerp. Ten vierde kan de analyse realistischer gemaakt worden door het introduceren van inkomensverschillen, een suggestie die ook van toepassing is op de analyse die wordt gepresenteerd in Deel I van dit proefschrift.

Een mogelijkheid voor verder onderzoek gerelateerd aan de onderwerpen die gepresenteerd worden in Deel III van dit proefschrift is om te testen hoe de activiteiten van groepen zoals de ETA, IRA of Hamas afhangen van de politieke situatie in respectievelijk Spanje, het Verenigde Koninkrijk en Israël. Een meer theoretische uitbreiding is het introduceren van meer dan twee spelers in een dynamisch model. In werkelijkheid zijn er namelijk vaak meer dan twee spelers betrokken in een conflict.

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